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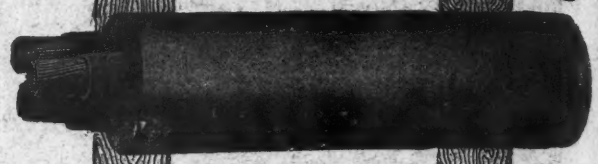

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ENGINEERING AND SCIENCE.

IT is gratifying, especially to those who for years have advocated a closer alliance between science and industry, to observe that the tide of public opinion continues to set strongly in that direction, and that a flood of exhortation in the Press and on the platform is being poured forth by men who occupy foremost positions in the ranks of both these parties; we earnestly hope that the movement will not end in words, but will develop into vigorous and wholehearted action. The current month has already seen a conference held by the Society of Engineers to promote the application of scientific research to engineering needs, at which Prof. Fleming once more laid bare the deficiencies of our existing system—or lack of system—and pointed out the remedies; a meeting of the Iron and Steel Institute, at which Sir Wm. Beardmore dwelt upon the application of science to industry; a meeting of the Textile Institute, at which Dr. Garnett urged the need of reform in our educational methods in order to attain a higher standard of efficiency in industry and commerce; and a meeting of the Institute of Metals, at which Prof. Bragg showed how the properties of the Röntgen rays could be utilised in the study of the structure of metals. Here is activity, indeed.

Both Prof. Fleming and Dr. Garnett referred to the advantages derived by our enemies from their more practical system of education, as compared with our own, which is so largely devoted to cramming with knowledge (largely academic and remote from every-day life) instead of the development of the faculties of reasoning and observation.

The late Prof. Ayrton continually impressed upon his staff the principle that the purpose of a scientific training was to teach the students *to think;* for this purpose, a knowledge of fundamental principles was essential, but there was no need to memorise a mass of facts. In the same way, Prof. Fleming insists upon the importance of producing "men who can do new things, and not merely know about old ones." He draws attention again to the inadequacy of the instruction in the public schools, which results in the loss of valuable time at college which has to be spent in making up arrears; this is also referred to by Dr. Garnett, in connection with the education of the worker, and he points out that reform must commence in the training school, with the future teachers themselves. Years must necessarily elapse before the effects of such reform can become operative in the technical schools and colleges, and, consequently, it is imperatively necessary that this question should be taken up at the earliest possible moment. It is a matter of the utmost urgency.

The demand for compulsory attendance at secondary schools, while in harmony with the spirit of the times, would probably be superfluous if employers would recognise the value of the certificates obtained by evening-class students, which, as a rule, are brushed aside with the disdain that is born of ignorance; if superior attainments could be sure of a due reward, they would be voluntarily sought after.

Dr. Fleming laid great stress upon the importance of cultivating and encouraging originality of thought. Led by men who are deficient in scientific and engineering knowledge, we have been handicapped in the past; we need only cite the examples of the motor-car industry, the manufacture of air-

craft, and the development of submersible ships. The theory of our political incompetents has been: "Let us wait and see what other nations are doing; when they have made this thing a success, at their own expense, we will reap the benefit of their experience." No more disastrous policy could be conceived; to follow in the steps of others is to commit industrial suicide, and we hope that not the least of the benefits to be derived from the war will be the abandonment of this theory for ever.

We have space only to refer to one other feature of Dr. Fleming's address—his contention that the Government ought not to appoint committees of experts, but should work through the medium of the technical and scientific associations which already exist. Is the Government policy wrong? Have not these societies existed for decades, without directly exerting any appreciable influence upon the course of industry and commerce—subjects which they regard with supercilious contempt? With few exceptions they are, as Dr. Fleming himself admits, mere paper-reading societies, distinguished mainly by their stilted ideas of propriety and their narrow-minded attitude towards mundane affairs. It is the *Committees*—such as the Engineering Standards Committee, the Electric Vehicle Committee, and a few others—and never the *Councils* that get things done that are worth doing.

Daylight "Saving."

Sir Henry Norman's resolution in favour of the adoption of the late Mr. Willett's scheme for "saving daylight" came before the House of Commons on Monday last, and was adopted with the minimum of opposition. The House of Commons has thrice rejected or dropped the measure, which was first introduced eight years ago, but it is now brought forward under most exceptional circumstances, for the patriotic purpose of economising coal, and though we regard it somewhat in the light of a wolf in sheep's clothing, we cannot but acknowledge the powerful aid with which it seeks adoption.

In our issue of April 28th, 1911, we set forth at some length the grounds for our opposition to the original proposal; in brief, these were as follows:—the Bill was *optional*, and its partial adoption would have resulted in chaos: a change of time on our part would have thrown our foreign communications by sea and by telegraph out of phase with the rest of the world, especially our European neighbours; tide tables and other standard publications prepared long in advance would have been thrown out of gear; the change was sought by men who thought they would derive advantage from it, but not by the vast bulk of the population; and there was grave doubt whether the alleged advantages would be realised.

The situation has changed, for the measure will now be made compulsory, thus avoiding confusion; we have no dealings with the Central Powers, Holland has already changed the time, and France, Denmark, Norway, and Sweden are likely to follow suit, so that the communication difficulty is largely removed; many of our works are in operation day and night, and will therefore be unaffected by the change; and the compelling argument advanced in favour of the change is national economy. Our case is, therefore, greatly weakened, but by no means destroyed.

To begin with, a new factor has come into existence in our favour: the Ministry of Munitions wants benzol and toluol, derived from the distillation of coal, agriculture wants sulphate of ammonia, the textile industry wants tar for dyes, and Diesel engine users want tar oil; we have, therefore, been urged to use gas freely—how does this square with the economy advocated by the Home Office, which has cordially welcomed the proposal? The Board of Trade is also pressing for a 10 per cent. reduction in the consumption of coal for lighting purposes, apart from the daylight saving scheme, and this, again, will hit the Munitions Department, which, on the other hand, is calling upon electricity works to increase their output for power supply. What does the Government really want?

It is curious to read in *The Times* that gas and electricity undertakings, which would be directly hit by the scheme, "*regard its adoption with equanimity.*" The reduction in street lighting and the general lighting restrictions "have already had their effect"—and what follows? Surely, it is obvious that if the suppliers of light are indifferent to the measure, because its effect has been anticipated by other causes, the economy of coal that is hoped for cannot be realised; the Bill is already discounted. As for the street lighting, that goes by the sun, if it is not in fact wholly cut off, and no economy will be effected there; there is little shop lighting to save, and therefore the bulk of the economy must come from domestic consumption. Now, as mentioned above, the Board of Trade is urging the public to reduce their lighting by 10 per cent.; it is important that this fact be kept in view, for it overlaps the daylight scheme, and in all probability the advocates of the latter will claim for it, unjustly, the whole of the joint economy, thus producing a false impression of its benefits.

It is well known that agriculture has no use for the measure; the workpeople must be guided by the sun. As for the many workers who have to rise at five, in order to start work at six o'clock, these will rise with the sun until the middle of July, but throughout August and September they will get up in the dark; during a great part of September they will have to work by artificial light for the first hour, thus losing at one end what is gained at the other. In many cases the change will have no effect at all upon the lighting hours until the middle of August.

We feel that, with other European countries, we are about to take part in the perpetration of a trick upon ourselves, a voluntary self-deception, which is revolting to our intelligence and a slur upon our moral strength. Let it be granted that in the summer months it is desirable to rise earlier—could not that end be attained by other means, less suggestive of the child's "make-believe"? We see one ray of sanity in the speech of Mr. Herbert Samuel on Monday last—he said the Government would not think of favouring the proposed change unless they had reason to believe that it would be advantageous for war purposes. It is consoling to know that the proposal is now put forward for adoption purely as a war measure, and not on its own merits.

Copper.

Developments in the position of copper have been of a rather startling character, as testified by the further huge rise recorded in prices within the last few weeks, and there is as yet no sign of a halt in the upward movement, for it is increasingly difficult to secure spot or near copper of almost any description, even at the extreme prices now current. Reports from across the Atlantic are as strong as ever, consumers in all directions being anxious to have deliveries against current contracts in order to keep pace with their heavy requirements. The uncertainty regarding the tension between the United States and the Central Powers, and the fears of Labour disturbances, do not appear to have had the least effect on the temper of the market. Speculation on this side remains absolutely barred by the Government prohibition, which is to be regretted, for it was undoubtedly speculation or the operations conducted by large dealers which were instrumental in keeping down the price of standard copper, prior to the enforcement of the new regulation, at a much heavier discount than at present is the case. In the middle of last month the price of standard copper was in the neighbourhood of £125, and has

now reached about £140, while electrolytic, of which the bulk of the American output consists, has risen during the same period from about £137 to £150. The premium on spot and near copper for weeks past has been constantly on the increase, owing not only to the fact that American producers have very little actually available for sale to meet urgent needs, but also to the virtual extinction of the stocks in home warehouses. With America producing at the rate of about 80,000 tons a month, and consuming as much as 75 per cent. of that amount, or something like 60,000 tons a month, it is at once realised that the exportable surplus is comparatively small, in fact, rather inadequate, in order to cope with the huge European war requirements. Within the last few weeks the additional orders placed by the Allies are stated on pretty good authority to have been as much as 150,000 tons, or representing but little less than a two months' American production, this to say nothing of the orders given out by American consumers. The world's output in 1912 was, roughly, quite one million tons, to which the United States contributed about 70 per cent., or fully 700,000 tons. The world's output for the current year has been estimated by a fairly reliable authority as 1,202,000 tons, to which America will contribute about 79 per cent., or 936,000 tons. The present position is absolutely unique, both output and consumption being a long way in excess of all previous records, with unsold stocks practically non-existent and a rise in price not seen within living memory. The course of the market, of course, depends largely on the duration of the war, or developments in the political situation calculated to hasten the conclusion of peace. Anything happening in the latter respect would probably have an important bearing on the demand, but the speculative market having been killed by Government action, the tendency of warrant copper cannot be expected to be immediately very materially affected unless some selling pressure makes itself felt.

Commission Agents and Remuneration.

Most commercial men have received or have paid commissions in their time. Some business houses, indeed, appear to rely entirely upon the efforts of the "men on the road" to bring grist to the mill in the form of orders; but while this method of bringing buyer and seller together is well recognised, the principles by which the question "Has this commission been earned?" must be answered are not always clearly understood. A recent case in the King's Bench Division shows that the person employing an agent may be liable to pay commission although he derives no benefit for the services rendered. In that case by a contract between the plaintiffs and the defendants it was provided that if the plaintiffs procured for the defendants a contract to supply certain motor-lorries to the French Government, the defendants were to pay the plaintiffs a commission immediately after the defendants had received payment from the French Government. The lorries were to be supplied from Turin, the defendants not being the makers. The contract was procured by the plaintiffs for the defendants, but the latter were unable to get the lorries, and the French Government cancelled the contract and paid the defendants nothing. In an action to recover the commission, it was held that as the defendants had put themselves forward as being able to supply the lorries, the non-receipt of the money was caused by the default of the defendants, and the commission was payable.

The principle underlying this decision was that when it is a term that the commission is payable on the receipt of the money by the other party, it is payable even though the money is not received if the non-receipt is caused by the default of the person employing the commission agent. It is to be observed that the application of this principle will not be avoided merely by inserting in the agreement a term to the effect that commission will only be payable "on orders accepted." A man may very well accept an order, only to find, on trying to carry it out, that it is commercially impossible to do so. For instance, suppose an agent has obtained an order for certain electrical machines, and the order has been accepted by the firm employing him. Subsequently it is found that to carry it out will involve such an expenditure on capital account that there will be a loss. If, in these circumstances, the firm decline to go on with the business, they will be liable to pay the commission due to the agent. The difficulty can be got over in one of three ways: (a) by the exercise of great care in the acceptance of an order; (b) by strictly limiting the classes of goods or orders which the agent may obtain; or (c) by drawing the commission note in such a way as to prevent the agent making any claim unless the order is not only accepted but carried out. We have heard recently of a case in which a firm engaged before the war in the manufacture of electrical fittings and apparatus had a claim made against them by an agent who had secured an order for munitions from the War Office. The firm accepted the order, only to find that with the plant at their disposal it could not be carried out except at a serious loss. Eventually, owing to delay, the War Office authorities cancelled the order. The claim of the agent was eventually compromised; but it is plain that the firm were in danger of having to pay the commission. These notes may suggest to those engaged in the electrical industry the advisability of revising or paying rather more attention to the terms of commission notes.

Water for Turbines.

A case which decided a point of interest to all those who use water for driving turbines was reported in our issue for April 28th. The action was brought by one James against the Bedwellty Urban District Council for a declaration that the defendants were liable to pay and make good to him the amount of the damage caused to him by nuisance arising from the pollution of the River Rhymney by sewage matter, which clogged the vanes of his turbine. Mr. Justice Astbury came to the conclusion that, while the clogging was partly due to grit and coal dust in the water, it was largely and mainly caused by sewage matter which could only have been kept out by the plaintiff enlarging his screens at very considerable expense; he awarded the plaintiff £150 damages and the costs of the action. This case is an illustration of the fact that a riparian owner has a right to have the water flowing past his land pure and unpolluted. In the days of the old watermill a little pollution by sewage would possibly have made no substantial difference to the working of the mill, but with a turbine it is otherwise; any impurities in the water appear to have a deleterious effect. While it is possible that a turbine would stand a certain amount of impure water at intervals, the constant flow of sticky matter would tend to clog, or of fluidy matter would gradually wear away, the blades of a turbine. It is important to notice that the right of a riparian owner to have his water unpolluted is an absolute right; so that it would be no answer to an action for the authority running sewage into the river to say: "You knew the sewage was there when you installed your turbine," unless, indeed, a right to pollute has been acquired by Act of Parliament, or by prescription; that is to say, by uninterrupted user for a period of years.

SURFACE MINING ELECTRICAL PLANT.

THERE is practically no class of machinery employed in connection with mining work which has not been adapted for electric driving, the size of plant ranging from the small ventilating fan to the largest main winder equipment.

The advantageous use of electricity in underground mines is fully appreciated by all engineers, but its possibilities for shallow and surface mining work have not been developed in the same degree as for underground work. With surface mining, the area and position of operations may be altered within very short periods, depending upon the locality and conditions of working.

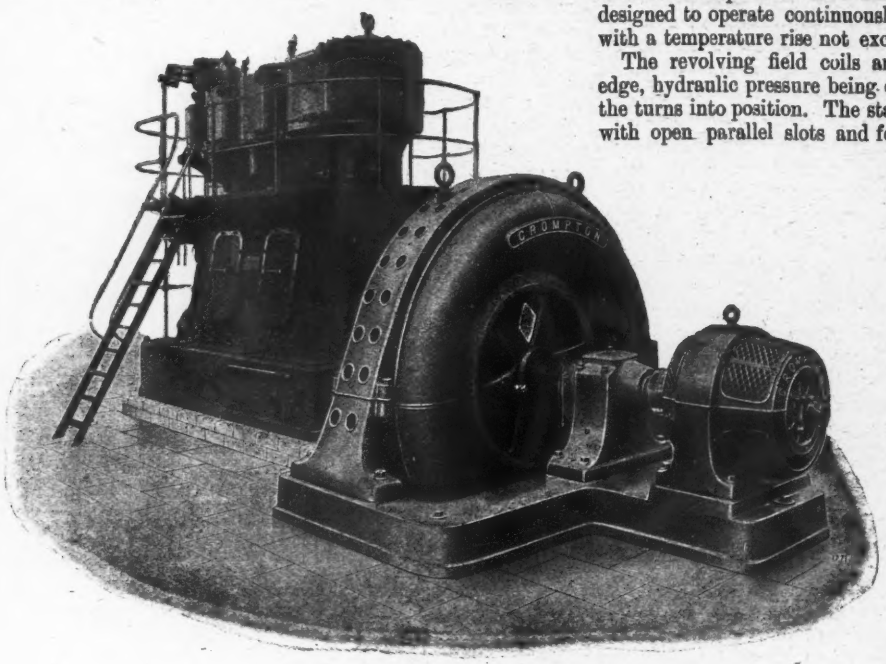

FIG. 1.—600-KW. STEAM ALTERNATOR.

For various reasons, such as the difficulty of illumination and supervision of native labour, night working has not been adopted by many of the principal mining companies owning surface workings in different parts of the world.

The following illustrations of plant supplied by Messrs. Crompton & Co., Ltd., of London and Chelmsford, will, therefore, be of interest in showing the possibility of continuing the operations day and night, even when the workings are extended over considerable areas.

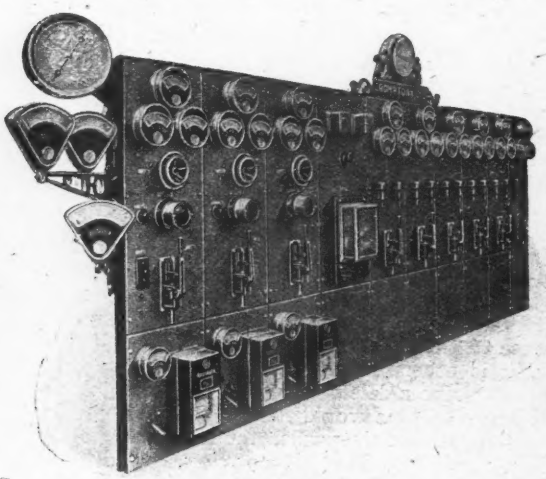

FIG. 2.—MAIN SWITCHBOARD.

Two well-known mining companies some time ago decided to adopt electric driving throughout their surface mines. The material in the workings was principally washed from the cliffs and headings by hydraulic pressure, and it was necessary that the electrical equipment should permit of the maximum output being obtained throughout the 24 hours.

In view of the extended nature of the workings and the necessity of carefully supervising native labour, the illumination at night was carried out principally by searchlight projectors, each fitted with lenses giving a widely diverging beam of light.

The electrical installation consists of three steam alternators, each having a normal three-phase output of 600 KW. at 550 volts, 50 cycles, with a 0·8 power factor; a view of one of these sets is shown in fig. 1. The alternators are of Messrs. Crompton & Co.'s standard construction, and are designed to operate continuously at their full rated output with a temperature rise not exceeding 70° F.

The revolving field coils are of copper strip wound on edge, hydraulic pressure being employed in winding to force the turns into position. The stationary armature is provided with open parallel slots and former wound coils, the latter being dried in a vacuum and impregnated under a pressure of about 50 to 60 lb. per sq. in., with special insulating and waterproof varnish, without breaking the vacuum. The armature and field coils of the exciters are treated in a similar manner.

In fig. 2 is shown the main switchboard, designed to control three alternators and feeder circuits. The alternators are paralleled by means of a synchronoscope mounted on a swing bracket at one end of the board. The alternators are protected by circuit-breakers with no-volt and reverse-current trips, as well as overload trips on the circuit-breakers on the feeder panels. A complete installation of lightning arresters is also provided.

All the feeders are of bare copper, carried overhead on porcelain insulators fixed to cross arms attached to wooden poles.

As most of the mining machinery is adjacent to the generating station, a pressure of 550 volts was adopted, but for the outlying district static transformers mounted on the transmission poles increase the pressure to 2,000 volts.

A general view is shown in fig. 4 of the hydraulic plant in operation, washing soil from the cliffs so as to expose the metallic strata and ore, thereby facilitating the collection of the ore.

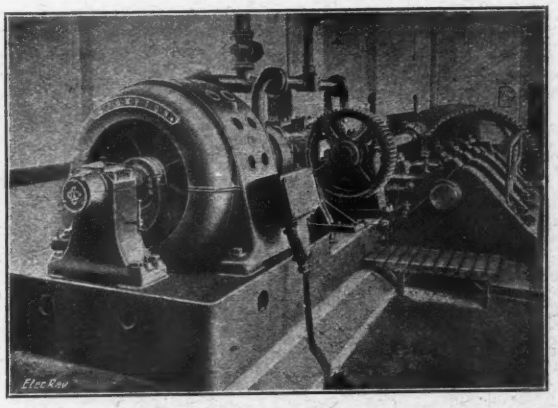

FIG. 3.—THREE-PHASE MOTOR DRIVING HYDRAULIC PUMP.

In fig. 3 is shown a high-pressure three-throw ram pump driven by a "Crompton" three-phase induction motor, which supplies water power to various nozzles for washing the cliffs. The rotor is of the slip-ring type, and is fitted

with brush-lifting and short-circuiting gear, which eliminates all friction losses of the brushes and rings, as well as the losses in the rotor leads, after the machine has attained full speed.

No special mention is necessary in connection with the motors driving the usual mining machinery, such as main and tail haulages, auxiliary pumps, concentration plant, crushers, puddlers, agitators, &c.

Fig. 4.—Hydraulic Mining Plant in operation.

To ensure the maximum efficiency of the illuminating plant for night operations, it was necessary to employ searchlight projectors working with continuous current obtained from rotary converters, one of which is illustrated in fig. 5. These rotary converters are self-starting from the three-phase side, the pressure being reduced by static transformers to about 65 or 70 volts, in order to obtain approximately 100 volts on the D.C. side.

The switchgear mounted on the side of the rotary is for starting purposes, and also for reversing the field windings, so as to ensure the correct polarity being obtained on the D.C. side when starting up.

For this class of work the converting plant should be designed with a view to portability.

The continuous current from the rotaries supplies various 36-in. searchlight projectors. One of the projectors is illustrated in fig. 6, and is designed for controlling the training and elevating motions by hand, through gearing, or electrically from a distance, the motors for the two motions being fitted in the base of the projector. The projector lamps operate automatically, and run with a small steadying resistance in each lamp circuit.

The projectors have parabolic glass mirrors and dispersion lenses mounted in special frames, which can be rapidly attached to the front of the projector, either by hooks or hinges, and which give a beam of light diverging either vertically or horizontally, as desired.

It is possible that considerable economy in operation might be obtained by electrically controlling a number of projectors from a distance, by a single operator situated at a central position in full view of the operations, or in communication with the workings by telephone.

The disposition and number of projectors employed would naturally influence the D.C. voltage and type of converting plant. It is quite probable that the most satisfactory arrangement would be to provide a motor-generator with each projector, consisting of a three-phase induction motor operating direct from the overhead lines, and coupled to a D.C. generator and small exciter so as to obtain a drooping voltage characteristic. This would enable the projector to operate automatically, thereby avoiding the necessity of a steadying resistance in the lamp circuit.

In fig. 7 a view is given of one of the workings taken at night. The workmen can be clearly discerned conveying the ore in trucks from the workings to the haulage gear station.

A general view of the mining area and generating station, &c., is shown in fig. 8. This view was also taken at night under ordinary working conditions, and clearly shows the arc lamps on the main road from the mine buildings to the principal workings.

There are numerous instances of surface mines extending over considerable areas, which are often of a temporary nature, and where it is not practicable or convenient to erect overhead lines for a power supply for night operations. In these circumstances, the many advantages of a portable projector equipment cannot be over-estimated. It consists

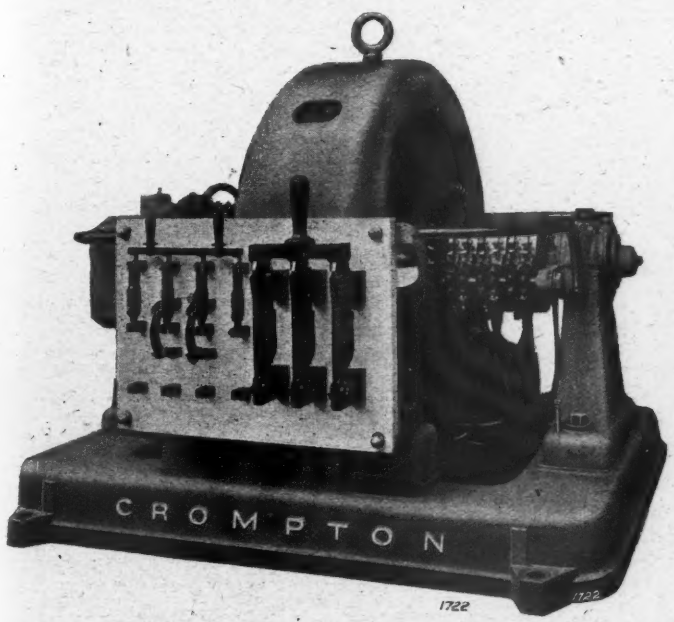

Fig. 5.—Rotary Converter with Starting Gear.

Fig. 6.—Motor-controlled 36-in. Projector.

of a petrol-driven chassis, the engine being arranged to drive the car or the generator for supplying the projector, when stationary. The projector burns with a normal current of 120 amperes at about 65 volts at the arc, and has a mirror of 36-in. diameter. It is shown mounted on a light trolley, so as to be capable of being easily moved in any direction. The supply cable from the chassis equipment to the projector is carried on a drum at the rear of the car.

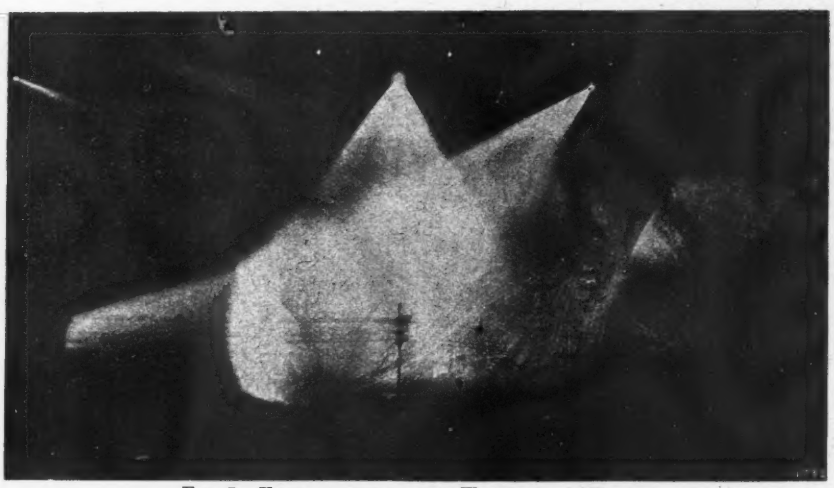

FIG. 7.—VIEW OF ONE OF THE WORKINGS AT NIGHT.

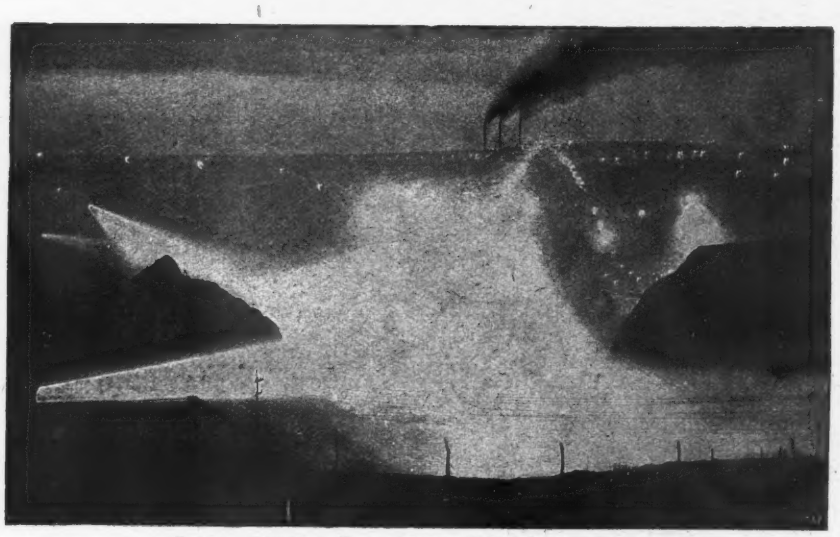

FIG. 8.—GENERAL VIEW OF THE MINE AREA AT NIGHT.

A similar equipment could also be usefully employed with other classes of outdoor work at night, such as the illumination of docks, shipyards, and all kinds of erection and excavation work, where the conditions of working require a high degree of illumination.

ENGINEERING AND SCIENTIFIC RESEARCH.

BY J. A. FLEMING, F.R.S.

(*Abstract of paper read before the* SOCIETY OF ENGINEERS (INC.), *May 1st*, 1916.)

THERE seems to be a very complete agreement that one result of the great war in which we are engaged will be to render absolutely necessary certain reforms in our national systems of education, and especially in the attention given to scientific knowledge. An important step was taken by the Government through the Board of Education last July in the establishment of a Committee of the Privy Council and the appointment of an Advisory Council to deal with the question of scientific and industrial research as described in a scheme outlined in a White Paper.

Since any such Government control over scientific research is bound to have a great influence in time on the direction of scientific work and its applications, it appears most desirable to gather views upon this scheme, even after its inception, from those who are concerned with one of the most scientific of these industries, viz., engineering in all its branches.

Important industries have died out or never thriven in this country in consequence of our neglect of scientific education and research. We cannot undo the effect of this neglect by a wave of the wand; reforms to be useful must be very deep and very thorough, and begin at the top and at the bottom in our systems of national education.

It is unquestionable that the success of the Germans in the commercial field is in part due to their system of national education, which prepares every man for some vocation and does it thoroughly. We are by no means desirous of copying it in its entirety, as it possesses grave defects on its ethical side and in its extreme cultivation of materialism in its worst aspects; nevertheless, we can usefully draw some lessons from it.

Our own educational systems are too bookish, too much devoted to the cultivation of memory and words, and not sufficiently leavened by a real knowledge of the facts of nature and power to draw true inferences from observations. One barrier in the way of our industrial progress has been the imperfect scientific training of foremen, managers and young heads of departments in many engineering works. The young men who are brought in to fill directing positions have generally received the usual public or middle-class school education, with its entirely insufficient attention to scientific subjects. Even when this has been supplemented by a course at a technical college, the time at the latter has been so much taken up with learning things which ought to have been learnt at school that the opportunity of acquiring advanced scientific knowledge or real power of independent investigation has been very much curtailed. Hence, when once immersed in business it has been impossible for them to keep up with scientific advances, and they can at most copy what they see others do. We have to produce more men who can do new things, and not merely know about old ones.

Until this state of affairs is remedied it is perfectly futile for Great Britain to hope to gain pre-eminence over Germany in scientific industries. The advantages which we have in greater originality of mind and better workmanship are neutralised to a large extent by the want of a sufficiently thorough and broad scientific education to enable us to see the practical value of, and work out exhaustively, and especially with reference to trade purposes, the openings given by scientific discoveries. It is the want of this sufficiently thorough scientific education which accounts for the limited faith of many employers and capitalists in scientific research, and also for the inability of the practical worker to take advantage of, or see the meaning of, facts which present themselves to him in his every-day work.

One of the educational reforms which seems most necessary is the compulsory attendance of lads after leaving the board school at a technical continuation school. Assuming he leaves at 14 or 15 and is taken on at an engineering works, it should not be optional whether he attends a continuation technical school. He should be compelled to do it until he is 17 or 18 years old, as in Germany. This continued education should not be merely a handicraft training, but should be a careful instruction by practical engineers in mechanical drawing, graphics, mechanics, physics, chemistry, metallurgy, electrotechnics, and machine construction. The attendance should not be allowed to become irregular, and the certificates of proficiency should have an immediate effect on the lad's prospects of advancement.

In the case of young men of higher social rank who have been to public schools, the practical experience in the shops and drawing-office should not be deferred entirely until after the college course. The school education should have provided them with a thorough grounding in the elements of chemistry, physics, and mathematics, pure and applied, and a speaking acquaintance with at least one modern language. One year at a university or technical college should then prepare them to take advantage of some shop experience, and after that they should return to the college for a year or, perhaps, two for the advanced laboratory and designs work.

The degree or diploma examinations should be made to depend more than at present on the results of practical laboratory and drawing-office work. My experience is that students who come straight from school to college for three years without break are less serious workers than those who have had some experience in an engineer's shop and then returned to the college.

In order to compress into this time the necessary training, our methods and means of instruction must be much improved. It is essential now for every engineer to have a good working acquaintance with certain branches of mathematics. If he has no knowledge whatever of the calculus or trigonometry he finds it impossible to read many original papers in the technical journals. In teaching electrotechnics to young engineers, I find I have to give much time to imparting elementary mathematical knowledge which ought to have been gained elsewhere. It should, however, be taught by engineers to engineers.

The great thing to guard against on the part of the student is premature specialisation. He should broaden as much as possible his knowledge of the principles of chemistry, mechanics, physics, mathematics, and metallurgy, and he will then be able, later on, to build up on this foundation. Unless he does lay this foundation he will not be able to follow or assist in improvements. As an illustration of this, we may take subjects such as telephony or wireless telegraphy. It is impossible now for anyone to make any really important addition to these subjects who has not a very competent knowledge of physics and some parts of mathematics. The easier problems are worked out and the design of telephonic systems or radiotelegraphic stations has become a matter in which advanced scientific knowledge is an important factor. Then, again, to make any advance in metallurgy requires a very intimate acquaintance with the chemistry of metals. A lucky accident might give a clue to an improvement, but an observer not sufficiently acquainted with modern chemical principles could not take advantage of it or follow it up.

In the third and fourth year the student will, of course, have given time to learning as much as possible of the methods of testing—both mechanical and electrical—required in engineering work, the especial object of which is to enable him to deal with the kind of problems which will present themselves in practice.

It is of extreme importance that he should acquire sympathy with and confidence in scientific research to give the data for engineering work.

We then turn to the subject which it is our purpose more particularly to discuss, viz., the relation of scientific research to engineering practice.

There are first the laboratory researches, which aim at determining various physical constants of the materials used in engineering which are requisite to give data for design. This knowledge can never be made too accurate or too complete; but the moment one goes to any of the well-known pocket-books or tables of engineering data it is astonishing to find the wide gaps in our knowledge. Hence, we require abundant provision for re-determining these values for particular samples of new materials to be used in bulk for various purposes.

In the second place, there are those researches which aid engineering by providing new methods of examination and test of materials or structures. An an instance of this, consider the invaluable aid rendered by what is now called metallography, or the study of the internal structure of metals and alloys by the aid of the microscope. Every engineering student is now familiar with the processes applied and with the immensely important knowledge that has been gathered as to the composition of steels and other alloys by this method.

The great development of pyrometry and high temperature thermometry by the invention and improvement of the thermo-junction and radiation pyrometer and the electrical resistance thermometer have provided the engineer with implements of great accuracy for the measurement of high temperatures and made it, in fact, an exact science.

The improvement in the means of testing the mechanical or elastic properties of engineering materials by testing machines is another instance of the same class of research. Of late years, the appliances for testing the mechanical properties of materials under repeated stresses, vibrations or blows have become important in giving the dynamic as contrasted with the static stress properties.

In the third place, we have a type of research which calls for special aptitude and insight, viz., those which lead to the discovery of some new process, material, or machine.

An excellent example of this is the discovery which rendered the production of metallic aluminium in bulk a commercial possibility; further examples of the same important class of researches are given in the production of the various alloy steels with extremely valuable properties.

This originative power is partly due to natural gifts, partly to effective training, and partly to the possession of sufficient appliances and means.

Originality stimulates originality; a really great investigator not only discovers himself, but imparts something of his powers to his associates. Hence we require to establish and strengthen those research institutions such as the Cavendish Laboratory, Cambridge, or the Royal Institution, London, where notable scientific investigators have established schools of research and imparted some of their great powers to students and colleagues.

In providing a large mass of accurate scientific data for use in engineering; the National Physical Laboratory has given most valuable service for the last twenty years. Nevertheless, there are matters requiring assistance for which even its present resources are insufficient.

In Germany much of the technical research work is carried out by private associations of the trades concerned. In Great Britain manufacturers in the same trade are far too prone to regard one another as rivals, whereas in the future they will have to stand shoulder to shoulder much more against their common and German antagonists, who will be united against them. In many matters it would pay British firms in the same business to promote scientific research in common on certain problems of manufacture, subscribing together the funds to undertake it either at a National Technical Laboratory or at some Technical College or University which may be provided with the proper equipment. Such information when obtained would then only be communicated to the members of the association or union.

The same principle of common action might be brought to bear upon the collection of information as to what is being done in certain branches of manufacture; the establishment, in fact, of an information bureau common to certain firms or manufacturers. Trade associations such as the British Electrical & Allied Manufacturers' Association are doing and could extend this work with great effect.

As a rule, British technical firms do not expend anything like the same labour or money over their intelligence departments as German firms. The latter gather in from all countries every scrap of information which can assist them, both from scientific and technical papers and patent specifications. The first direction in which our advances should be made is in improving the means for obtaining this early information on possible improvements and advances.

Many important problems which need attention are very large ones and will require the assistance of many experienced men. Such problems are the conservation and more economical use of our national coal supply, the universal adoption of gas or of electric heating in place of the wasteful combustion of raw coal in domestic fireplaces, and the electrical transmission of power from coalfields to great cities. Hence, it is to be hoped that the principal engineering institutions will unite in a strong request to the Government, if they have not already done so, to place representative engineers upon the Advisory Council, and also that in the disbursement of funds allocated to the assistance of industrial research, these institutions, as bodies, shall be to a considerable extent the avenues through which it is dispensed.

The present policy of the Government and of the Board of Education seems to be the creation of fresh committees and boards, whilst setting on one side the existing learned and technical institutions, which include in their membership all those who have special knowledge and eminence in their various subjects.

Mr. Runciman has recently appointed certain committees to report on measures to safeguard the commercial interests of the iron, steel and engineering trades, and on shipping and shipbuilding. The Advisory Council for Scientific and Industrial Research is also appointing standing committees to deal with mining and metallurgy, and an engineering committee is promised as well. Furthermore, the Royal Society recently called a conference of about 25 of the chief scientific and technical societies, and it was decided to form a board to advise the Government on any branch of scientific inquiry which may be brought before it. The result of all this must be to diminish rather than increase the very organisation and co-ordination required.

The existing scientific and professional societies, if properly organised, would supply all that is required. These engineering institutions and societies should take a leading part in guiding the fortunes of the industries they represent, and not be reduced to the level of mere paper-reading or discussion societies.

At present, the Government prefer to ignore the existing societies and create fresh bodies of their own selection. The result will be to weaken these existing institutions and societies.

It is essential to guard against the bureaucratisation of science, and the safest and most simple method of avoiding this would be to make the great technical and professional institutions the means of advising upon the most important steps to be taken in aiding technology.

We have first to create a great change in the attitude of the public mind towards scientific knowledge and research and develop the conviction that until it is regarded as a most serious pursuit we shall fail to make any firm advances towards victory in industrial war.

No one who has studied German methods can fail to admit they have realised fully in commercial matters the truth that union is strength. Our ideal has been largely individualism

and competition, theirs has been organisation and co-operation. The German commercial system is essentially militant in nature and organisation. It is all part and parcel of the plan to achieve world conquest at any cost and by every means. Our post-war policy cannot, therefore, be simply defensive. No tariff wall can be built so high, no boycott of German goods so thorough, as to defend our position in the absence of a positive and vigorous policy of attack. Hence, the first condition of success must be association and combination, and the second the scientific method in all things.

The first principle of scientific investigation is to collect the facts and to draw deductions only by the light of full knowledge. The inference is that our information about foreign markets must be greatly increased. This means that our Consular reports must be improved, that foreign agencies must be staffed with men who have the necessary linguistic and scientific accomplishments, and that the study of foreign markets and of the nature of the foreign demand for goods shall be made a scientific study.

In the main, however, we have to rely on bringing to bear scientific knowledge of all kinds upon the manufacture and distribution of goods and obtaining foreign markets for the same.

The importance of a true education in science is that it leads to love of accuracy as to facts, loyalty to scientific truth, unwearying labour in obtaining it, and care in the inferences derived from it. We have to cut ourselves adrift from all the past, its easy, self-satisfied mediocrity, dislike of trouble, and contempt for knowledge.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electricity in War Areas.

My thanks are due to you for the copy of the ELECTRICAL REVIEW which reaches me here regularly. Even though one is not actually filling one's corner in the work at home, it is very gratifying to read of what others are doing, and of what is happening in the wide circles of electrical science and engineering.

Your correspondent's description of the utilisation of derelict machinery in the war area is very interesting. I have seen many instances where otherwise wasted energy could be made use of with advantage—ancient flour mills with overshot wheels offer very good scope in this direction. By the way, the condition of the wooden-teeth pinions in some of these old mills is really surprising—they have a wonderfully long life.

Perhaps it is not looking too far ahead when we express the hope that we shall soon see some examples of German engineering ingenuity "behind the line," an article on which appeared in the REVIEW some little time ago.

J. H. Pembrey,
A.S.C., M.T.

British Expeditionary Force, *April 30th*, 1916.

The I.E.E. Election.

I have just returned my ballot paper to the Secretary of the Institution of Electrical Engineers, and I regret to say that I consider myself justified in having erased the name of Mr. Sparks, who has apparently been nominated by the Council as President of the Institution for another year.

My action has been prompted through no hostile feeling on my part towards Mr. Sparks, because, as a matter of fact, I very much admire the way in which he has carried out his duties during the past year, but I entirely disagreed with the practice of electing presidents for two successive years. There are any number of eminent gentlemen who could quite well fill the position satisfactorily.

I believe there are any number of people who agree with the above sentiment, although they probably do not take the trouble to express their opinions in writing.

I am in entire agreement with the remarks regarding this matter which appear on p. 386 of your journal dated 7th ult.

I enclose my card, and sign myself

President for One Year Only.

May 3rd, 1916.

Justice for the Inventor.

Your leader, and the letter in the current issue of the REVIEW on the above subject, will certainly be appreciated by everyone interested, but more especially by those, like myself, who were just applying for a patent when the war started.

Briefly to state my own case: For some months before the commencement of the war I worked hard to perfect a device for which, at that time, there was a certain market; there were but a few days between the outbreak of hostilities and my application for the patent, and, hoping for the best, I paid the money, which I have since sorely needed.

The patent was granted, and I have since submitted the invention to certain people with a view to their adopting it; the opinions expressed regarding the merits of my invention were very pleasing, but there will be no market for it until we return to a state of peaceful industry. Three months from now, two years of the life of my patent will be gone, and as my invention is not of much use in connection with the manufacture of munitions, it is exactly in the position it was in when the patent was granted, and will probably remain so until a considerable time after peace is restored.

Nevertheless, if when the renewal fee is due I have had no return for my labours and initial outlay, and cannot afford the amount demanded, I lose everything. This is not very encouraging for British brains to help to capture the trade previously held by the enemy. It could hurt nobody, and would be only justice to the patentees, if patents which were shown to be adversely affected by the war were granted an extension of life, or, rather, a "stay of progression," equal to the duration of the war—by which I mean that the renewal fees and the ultimate expiration of the patent should be deferred to the extent of that period; but it must be free, or in many cases, like my own, it would be useless.

Invention is the seed of industry; therefore, if those who cultivate it are discouraged, there will be a scarcity of the seed.

G. W. W.

The Electric Cooker in India.

While agreeing generally with Mr. C. S. Jeffrey's article under this head, may I say that servants are not quite so impossible as he would make them. When I was transferred from Calcutta to Simla my servants aggregated 85 years' service, several having been with me over 15 years, while other long-timers died in my service earlier. Also, the fetish of charcoal for the kitchen is easily overcome. My cooks have always used coke except for pastry making. I have found the electric kettle and iron invaluable, but they *must* have an earth wire, for the reason given by Mr. Jeffrey.

J. W. Meares.

Clive Hall, Shrewsbury, *May 7th*, 1916.

INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

No report has yet been made public as to what took place at the meeting of Government electrical officials in Calcutta last cold weather. Their deliberations lasted over a week, and they are said to have worked very hard: the only tangible result up to now seems to be that a very good photographic group was taken—copies of which adorn their office walls in each presidency.

Mr. J. W. Meares, the electrical adviser to Government, has gone home on furlough, and his work is being done by Mr. C. C. Eastgate, who is Government electrical inspector to the Punjab. Mr. Tufnell, the electrical inspector to the United Provinces, has joined the Army, and his work is being done by Mr. Bell, who is municipal electrical engineer to Mussoorie Municipality. Mr. Warren ably assists Mr. Bell as assistant electrical inspector. Mr. R. J. Browne, electrical inspector to Bengal, Assam, and the new Province of Behar and Orissa, has gone home on sick leave. His duties are now divided between Mr. A. N. McIntyre, who takes over sole charge of Behar and Orissa Province, and Mr. A. K. Taylor, who is acting as electrical inspector in Bengal.

Lucknow.—The work of building and equipping the new power-house is making progress. This is in the hands of Messrs. Crompton & Co., who have now accumulated a rare experience in town lighting in India. No certain date is yet given for actual supply of current; but, judging by the multiplicity of electrical contractors now opened up in Lucknow, wiring work should be brisk—and inexpensive. The great ambition of the average Indian electrical engineer—be he the result of a technical college or, as more often is the case, the result of a few months' so-called apprenticeship with a European contractor firm—is to start on his own, open up a business with a high-sounding name, and get a few jobs, mostly from among relatives, and then, in most cases, go "phut," as the saying is, either from want of capital or, which is generally the case, from want of experience. Allahabad, which, as well as its sister city Lucknow, is going to have an electrical supply shortly, is also a happy hunting ground for the small one-horse contractor. This city is also being equipped by Messrs. Crompton & Co., and a good return

should be shown after a few years' working. In Indian cities like Lucknow and Allahabad, a certain revenue can be always counted on from large Government offices and buildings—a revenue almost large enough to pay interest on capital and establishment charges annually. The surplus may fairly be counted upon as profits. The hot-weather load, with its innumerable fans, is, of course, a feature of Indian electric supply.

It is surprising with what regularity machinery and electrical accessories are still imported to India, in spite of the immense shipping difficulties. Of course, the delays are considerable; but with a little patience the goods get here some time. Shortages are, perhaps, noticeable now in electrical accessories, particularly rubber and flexible wire, especially the latter.

Japanese electrical goods are making great headway, especially insulators, lampholders, flexible wire, and so on. The material is passable, though not up to English standard; insulators particularly are below the mark, their finish, instead of being white or creamy, is of a grey-bluish tint, due probably to the glaze. The adaptable Japanese will shortly, however, better this, and given another year of present conditions he will have a very firm grip on the Indian electrical market for light material.

WAR ITEMS.

Exemption Applications.—On the application of Mr. Dashwood, electrical engineer, the Canterbury Tribunal has granted another month's exemption to a wireman.

At the Newcastle Tribunal, an electrical engineer appealed on the ground that he supported his parents, and that his occupation was a reserved occupation. It transpired that his parents were not wholly dependent upon him, and that his occupation was with a cinematograph company. When told that he must serve, he asked whether he could go into a munition factory, and was told that he must fight.

At the Brighton Tribunal a lecturer in physics and electricity at the Brighton Technical College appealed for exemption on the ground of the importance of his work. The Brighton Education Committee also appealed for him on the ground that the work he is engaged in is of more national importance than his services in the Army would be. Six months' conditional exemption was granted.

At the Southport Tribunal a firm of electrical engineers asked for the absolute exemption of a branch manager on the ground that they were engaged in the supervision and carrying out of important Government sub-contracts and other jobs of national importance. He was 35 years of age, and the only eligible single man in their employ. The Tribunal said that it was not prepared to deal with the application; it would simply mark the man as at present holding a badge.

Before the Rawmarsh Tribunal, on May 5th, five employés—four connected with the generating station, and the other a motor-man—were appealed for by the Mexborough and Swinton Tramways Co. Mr. Priestley said that two of the men were switchboard attendants, and, in reply to the military representative, stated that there was not a girl on a switchboard in any generating station in the country. The military representative said he knew of cases of girls attending switchboards in important places, such as large theatres. If they could do that they could, with a little training, do the work of these men. The Chairman said he did not think girls could do the work of the generating station. A member suggested that older men could be obtained, and Mr. Priestley replied that there were great difficulties in the way of getting other men; considerable training would be required. The Tribunal granted exemption to each man until the end of June, the military representative in the meantime to ascertain whether the men were legally exempted under the heading of "Public Utility Service."

Before the Cornwall Appeal Court, Mr. John Jewell, of Redruth, appealed for exemption for his son, Mr. Wm. Jewell, electrical engineer, who was in charge of an electrical plant at a tin works. The Local Tribunal had granted two months' exemption. The Court considered that another man at the works could carry out the duties, and the appeal was dismissed.

At Nuneaton, exemption was appealed for on behalf of Mr. A. N. Lilley, aged 18, a pupil in the electrical engineering department of the Corporation. It was stated that the indentures expired on October 30th, and at the end of that period he would be put in the Officers' Training Corps or under the Admiralty. Exemption was allowed to the end of May only.

At Glossop, the Urban Electric Supply Co. appealed for a motor-man, but the request was refused on the ground that he was not in the position he held on August 15th, 1915.

At Dover, on May 3rd, exemption was applied for by the Corporation for Mr. Goodwin, traffic clerk on the tramway staff. It was stated that he was the only clerk left. A member asked if a woman could not do the work, and a negative reply was given. Exemption was allowed for two weeks from May 29th for a substitute to be found.

The Whitehaven Tribunal have granted exemption until June 20th to the son of a principal of a local firm of electrical engineers, and engaged in the business, which caters for firms who are on war work. It was stated that the only male left was a Belgian, and that the places of men who had left had been filled by women.

At Gloucester, the Corporation appealed for a motor-man engaged on the tramways. Mr. Corson, for the Council, said the time was quickly approaching at which the employment of women as drivers must be settled; it was a question whether women should be employed in such a capacity. As the service was still normal, it was contended by the military that it might with advantage be curtailed, and a number of men thus released. The appeal was put back to ascertain what arrangements could be made for releasing a portion of 13 attested motor-men who remained in the service.

Before the Gloucestershire Appeal Court, the Bourton-on-the-Water Electricity Co. applied for exemption for their assistant electrical engineer, on the ground that he was in a certified occupation—public utility service. It was explained that the installation supplied 1,463 lights, while the company ran a motor pump at the local hospital. The assistant engineer was the sole man in charge of the Bourton installation, his chief was stationed at Burford, and if he went his place could not be filled, and the town would be left without artificial light. The Tribunal granted exemption until Michaelmas.

The Herts County Tribunal has dismissed an appeal for further exemption for G. E. Way, electrician at the Berkhampstead Picture Palace, for whom a substitute had not been found.

At Oxfordshire Appeal Court, the military appealed against exemption granted by the Local Tribunal to Raglan D. Price, of the Oxford Electric Tramways staff, on the ground that he was not in a certified occupation. It was contended that Price only did the work of a mechanic. Mr. A. A. Tyler, manager of the tramways, said that Price examined the engines and fittings of 'buses, which were at the disposal of the military for the wounded free of cost. He was a fitter and did fitter's work. The appeal was dismissed, but the exemption was varied, and granted until November 2nd.

At Horsham, on Monday, a private estate electrician claimed exemption on the ground that he was indispensable, but he was allowed only a month's postponement.

At Bath, on Monday, the military appealed against exemption granted to Mr. W. J. Fussell (23), engaged with Messrs. Kendall, electrical fitters, and said that the man was employed in a private concern and should be released for service, while the age for men in this occupation to be regarded as reserved men had been raised to 30. The appeal was allowed, and exemption cancelled.

At the Stockton-on-Tees Tribunal, exemption was sought for 16 drivers employed by the Imperial Tramways Co., Ltd., on their Middlesbrough, Stockton and Thornaby system. It was stated that 115 men had been released by the company and provision made for their dependents. Since the last appeal to the tramway employés, a representative of the Ministry of Munitions had visited the company's premises, and, after investigation, admitted that the absolute limit had been reached so far as the release of men was concerned. The Chairman said the Tribunal was of the opinion that the number of drivers could be reduced, and that the single men should be spared. Mr. F. Freshwater, manager, replied that for every three men they took away, it would mean the taking off of a tramcar. Conditional exemption was granted in regard to nine drivers who are over 25 years of age, but the remaining seven were dismissed.

Russian Pressspahn.—A writer in a Russian semi-official journal, complaining of the want of tone in Russian industry, observes that the production of insulators in the country might be extensively developed, including special cardboard. Until the war opened, this cardboard—pressspahn—was imported from abroad, "that is Germany." When the war started, it was found that pressspahn could not be had at any price. But after inquiries, pressspahn was found within the boundaries of Russia itself. It appears that in Russia the manufacture of pressspahn and fibre has existed for a long time, but electrical industrialists were quite unacquainted with the fact. There were factories making pressspahn and fibre, using the pressspahn for binding copybooks and block notes, and they sold the fibre for the manufacture of peaks for caps and for cartridges. But pressspahn and fibre for electrical insulators were ordered from abroad. "These examples are extracted from the latest publications by the industrialists themselves. They are astonished by the fact, and are endeavouring to throw the blame on third parties."

Lighting Prosecution.—The manager of a large Middlesbrough drapery and furnishing establishment, when charged on May 2nd with having failed to observe the lighting regulations, pleaded that it was the fault of an electrician who had been doing work on the premises, and had tapped the wrong main. Instead of tapping one of the mains through the shop, he tapped a main controlling the lights in the whole of the windows. A junior switched up the lights in mistake.—Fined £2.

Johannesburg and Trade After the War.—According to the "South African Mining Journal," the Executive of the Johannesburg Chamber of Commerce has submitted a series of recommendations on post-war trade. They urge co-operation between the Imperial Government and the Dominions so as to make the Empire self-supporting; that the Imperial and Dominion Governments should be urged to encourage, for a period of years, the continuance by subsidy or otherwise of new and "key" industries established within the Empire prior to or since the commencement of the war, or which may hereafter be established; that the assistance of the Imperial and Dominion Governments in the organisation of industries is essential to a more complete development of the Empire's resources with a view to ensuring that each industry shall be enabled to obtain all its requirements from sources within the Empire itself; that steps be taken to prevent dumping and under-valuation of all foreign goods imported into British markets after the war, and certificates of origin should be required to be signed by British Consular agents; that the British Consular service should be strengthened by the appointment of men qualified to safeguard and promote the interests of British trade; and that it is of the highest importance that various Governments of the Empire should take steps for the development of technical institutions and scientific research, and their adaptation to industrial and commercial ends. They further urge that the Union Customs tariff should be amended in order to provide for preferential trading between all parts of the Empire; reciprocal arrangements with foreign countries, excepting present enemy countries (against whose produce and manufactures a prohibitive tariff should be enforced), and a special tariff on a prohibitive scale against the products and manufactures of present enemy countries; differential charges against enemy shipping; the prohibition of the entry of enemy trading journals, catalogues, and price lists; that no trading licences be issued to enemy subjects or to agents of enemy firms; that no foreign patents be allowed to be held in South Africa unless they are worked or the articles so patented are made in the British Empire; and that Government departments, municipalities and other bodies administering public funds should be required to confine purchases to products and manufactures of British firms whenever articles required are obtainable within the Empire.

Trading with the Enemy.—In the Cape Town House of Assembly, on April 26th, according to a Reuter dispatch in the "Times," the debate on the Enemy Trading Bill was resumed. Mr. Burton declared that the Government were determined to pass the measure during the present Session. General Botha described the measure as a deplorable necessity, but nevertheless a necessity, for the protection of the inhabitants of South Africa. He quoted a German Act of Parliament dealing with British interests in Germany, adding that if Germany at the end of the war refused to return the goods of British subjects, South Africa would be in a position to adopt a similar attitude towards German goods.

In the "London Gazette" for May 9th there appear new schedules of persons or bodies with whom trading is prohibited in the following countries, and alterations in previous lists:—Denmark, Greece, Japan, Norway, Philippine Islands, Portugal, Sweden, Brazil, Netherlands East Indies. A number of well-known electrical names appear in the lists.

Scarcity of Metals in Austria.—Reuter's correspondent at Zurich reports that lead and tin are now required very badly for military purposes in Austria, and new decrees have been issued for their requisitioning. Manufacturers and merchants are required to give up 80 per cent. of their stocks of lead and tin goods, including plumbing materials, baths and boilers. Type founders, printers and newspapers are also required to give up 20 per cent. of their type. If such reports as these regarding German and Austrian metal supplies be correct, it is not easy to reconcile them with reports of a coming big after-the-war dump of manufactured goods —and any rate, in the metal-using trades.

Municipal Corporations and Enemy Contracts.—Hackney B.C. is recommended by its General Purposes and Establishment Committee to support the Manchester Corporation in adopting similar standing orders with regard to contracts with foreign manufacturers, viz.:—That in future no contract shall be entered into with any person of German or Austrian nationality, or with any firm or company whose subscribed capital (whether by way of shares or otherwise) is held or controlled to the extent of one-third or upwards by persons of German or Austrian nationality.

Bacup Town Council last week adopted new standing orders to the effect that no contract be entered into with any person of German or Austrian nationality, nor with any firm or company whose subscribed capital was held or controlled to the extent of one-third or upward by persons of German or Austrian nationality.

An Australian Board of Trade.—In a discussion by the Melbourne Chamber of Commerce as to how to remove German trade influence, one member suggested the creation of an Australian Board of Trade.—"Times."

The Paris Conference.—The Parliamentary correspondent of the "Daily Telegraph" says that the Economic Conference of the Allied Powers in Paris has been fixed to commence on Monday, June 5th.

To be Wound Up.—The following further companies have been ordered to be wound up:—

Coutinho, Caro & Co., 134, Fenchurch Street, E.C., metal merchants. Controller: N. W. Wild, 22-28, Broad Street Avenue, E.C.

Wolf Safety Lamp Co., Boston Street, Sheffield, engineers and lamp manufacturers. Controller: T. G. Shuttleworth, Sheffield.

E. M. Brinckman & Co., 99, Redcross Street, London, S.E., merchants (electric lamps, batteries and gas mantles). Controller: K. C. Fox, 45, London Wall, E.C.

Enemy Firms in Hong-Kong.—The "Board of Trade Journal" for May 4th contains a list of enemy firms in Hong-Kong under liquidation, to some of whom British firms, obviously under misapprehension, continue to send advertising literature, trade papers, &c. The following appear in the list:—Arnold Karberg & Co.; Bume & Reif; Carlowitz & Co.; Siemssen & Co., Garrels, Borner & Co.

Artificial Limbs for Returned Soldiers.—Following the example adopted in Germany, an exhibition is about to be opened in Petrograd of artificial limbs specially designed to enable wounded soldiers to follow industrial employment when they return to civil life.

LEGAL.

HANDS *v.* J. DAVIS & CO.

AN application was made to Mr. Justice Astbury, in the Chancery Division on May 5th, to enter judgment for the plaintiff in the action by Albert Hands against J. Davis & Co. (Southampton), Ltd., electrical engineers, of Bedford Place, Southampton, the defendants having entered no defence. The action asked for a declaration that the plaintiff was entitled to a charge on the company's assets to secure the payment of debentures.

His Lordship entered judgment as asked.

CHARGE OF BRIBERY.

AT Leeds City Court, last week, Thomas William West (37) a War Office viewer, of London, was remanded for a week on a charge of attempting to obtain a bribe from Mr. A. S. Taylor, of Armley, works manager of the Cremer Lamp & Engineering Co.

MR. E. O. SIMPSON, for the War Office, said the defendant was a viewer, or inspector, in the Ordnance Department at Woolwich, and it was alleged that whilst visiting the Cremer Co.'s works at Leeds to inspect some lamps that were being made under contract, he offered to pass the lamps if he were given £5 half of which he would share with Mr. Taylor. There was another charge of falsifying accounts respecting the time spent in Leeds, which might be preferred against him.

The defendant pleaded "Not guilty," and said that after inspecting lamps Mr. Taylor took him to lunch, saying the "guv'nor" would pay, and it was suggested to him that he should stay the week-end and inspect some more lamps. He stated that he had not enough money with him, and, he alleged, Mr. Taylor said: "I could do with making a bit," and added that he would get £5 and they could go halves.

ILKLEY U.D.C. *v.* EVANS.

BEFORE the Otley Bench, on May 5th, Edgar W. C. Evans, electrician, Bradford, was summoned for fraudulently diverting electricity at Ilkley on February 10th.

It was stated on behalf of the Ilkley Council that the defendant was manager for Messrs. Christopher Pratt & Sons, Ltd., of Bradford, who electrically wired a number of premises at Ilkley. Amongst these was a shop, into which was put an electric motor. It was later found that two lights had been connected with the power meter, and thus the consumer was able to obtain electricity for lighting at the power rate.

MR. SIDNEY H. BILL, electrical engineer for the Ilkley Council, admitted in cross-examination that in Bradford and Leeds it was the custom to have two or more lights from the power meter, but this did not prevail at Ilkley. It was contended for the defence that the defendant had been accustomed at Bradford to connect one or two lights with the power meter.

Without asking the defence to call witnesses, the Bench dismissed the case, and ordered each side to pay their own costs.— *Leeds Mercury.*

SHRIMPTON AND ANOTHER *v.* THE NORTHERN LIGHT, POWER, AND COAL CO., LTD., AND OTHERS.

THIS case came before the Court of Appeal on Friday, May 5th, upon the appeal of the plaintiffs from a judgment of Mr. Justice Peterson. The matter was referred to in our issue of December 24th, 1915.

At the conclusion of the arguments, their Lordships dismissed the appeal, with costs.

THE ACCURACY OF ELECTRIC METERS.

AT Morpeth County Court on 8th inst., the Northern Counties Electricity Supply Co. sued Andrew Foster, a local tradesman, for £1 15s. 4d. for energy supplied.

Mr. P. Corder, who represented the plaintiffs, said it was a question of the accuracy of the meter.

The Defendant said he had refused to pay, because while he was using nine lights before the war, and had only used two since, the cost had been very much larger. He produced accounts in support of this statement. The meter had been changed three times.

One of the company's testers said the tendency of the meters was to go slower in use, rather than faster.

Mr. Bibliz, one of the company's electrical engineers, said the last meter had been tested and found to be quite accurate.

Judgment was entered for plaintiffs, with costs.

"Z" Electric Lamp Manufacturing Co., Ltd., *v.* W. Denton, Ltd.

In the King's Bench Division on Tuesday, May 9th, this case was in the list to be mentioned before Mr. Justice Rowlatt.

Mr. Whateley was for the plaintiffs and Mr. Merle for the defendants.

It was stated that the defendants now submitted to an order for the payment of a sum of £32 4s. 6d., and High Court costs.

Adams Manufacturing Co., Ltd., *v.* Broadbent.

In the City of London Court, on May 5th and 8th, before his Honour Judge Rentoul, K.C., an action, which had been instituted in the High Court of Justice, was brought by the Adams Manufacturing Co., Ltd., Bedford, against Mr. Frank Broadbent, electrical engineer, London, to recover £71 for electrical switches supplied.

Mr. C. P. Blackwell appeared for the plaintiffs, and Mr. Fortune for the defendant.

Mr. Blackwell said that the claim was really reduced to £43 by payment. It was brought in the name of the Adams Manufacturing Co. by Mr. Hardy, who was appointed the receiver and manager for debenture-holders by an order of the Court on April 11th, 1913. Various contracts had been sanctioned by the Court. The claim was for electrical switches sold by Mr. Hardy after his appointment. The company ceased to be able to carry on business on the appointment of Mr. Hardy. Defendant had admitted that except as to £20 the rest of the claim was admitted, but he said that the claim had been assigned by the plaintiffs to the Igranic Electrical Co., Ltd. In fact, it was intended to assign the debt due to the plaintiffs to the Igranic Co., but it was never done. Defendant had not paid the Igranic Co. or the plaintiffs. Defendant had said that he granted to the plaintiffs full and exclusive licence and authority to manufacture and sell electric switches under letters patent, or any improvement or modification thereof. Plaintiffs agreed to pay defendant a royalty of 5s. on the price of every switch so manufactured. The agreement did not in truth confer on the plaintiffs any right to sell or manufacture in respect of any improvement or modification. There were several patents concerned; one had lapsed by effluxion of time because the defendant had not paid the necessary fees.

Mr. Fortune said that Mr. Hardy had gone, so far as the receiver was concerned, and the company were the real plaintiffs.

Mr. J. Morley, plaintiffs' solicitor, said that Hardy sold the business of the Adams Manufacturing Co. and the assets for £15,000 to the Igranic Co.

Mr. Fortune said that the wrong plaintiff was suing. The Igranic Co. had been using the defendant's patents for making electric switches on which defendant was entitled to royalties.

Mr. Blackwell said that the patents were not valid, and plaintiffs had been making the switches without licences, as they did not consider they were necessary.

When the hearing was resumed on Monday, the Judge said that the receiver and manager appeared to have sold the plaintiffs' business to Bacon, and Bacon sold to the Igranic Electric Co.

Mr. Blackwell: He did not sell this debt—that is the point.

Mr Fortune: They have given us notice of assignment of this debt to the Igranic Co., and the choice in action is in the Igranic Co. The sale was to take place on April 11th, 1913. The whole business passed to Bacon on that day. Hardy had no interest in the business; he was going to be indemnified as regards any outgoings. The claim is for electrical goods sold after April 11th. Hardy had it in trust for Bacon. Hardy could only sue as Bacon's agent.

Mr. Blackwell: Yes; but although the debt might become vested in Bacon, and that was contemplated, I say that it never has become vested in Bacon, although he can direct ultimately what shall be done.

Judge Rentoul was sure that neither side wanted to get a judgment that they could not hold when the other side went to the place which dealt only with points of law and had no conscience—the Divisional Court.

Mr. Fortune: They have treated everything as assigned to the Igranic Co. until they come to this action. We claimed this money we are now counter-claiming. The Igranic Co. have taken a part of the debt, and we are not claiming that.

Judge Rentoul said he could only consider the legal documents. No matter how many people had acted in the matter in another way, that could not affect him. If he could settle the case altogether—if there were no appeal—he might possibly look at what he thought roughly was the justice of the case, that did not enter into the matter at all.

Mr. Fortune: No. I am entitled to say: "I have a counter-claim against your principal, because you were only trustee or agent, and you have no interest in the action you are bringing; you are only a cloak for a principal." Leaving out the question whether the new patents are new patents or modifications, this action is by the receiver. I claim my minimum royalties on the 1906 patent so long as he has been receiver and manager.

Judge Rentoul: The first point is who is the right plaintiff and, as far as I can see, the plaintiff is the right man; the right to sue was never in the Igranic Co. There must be judgment for the plaintiffs on the claim. Now about the counter-claim.

Mr. Fortune said that must be regarded as another action in which the receiver was acting in the name of the Adams Co. The receiver had sold certain goods during the time of his receivership, and during that receivership there was a contract going on between the company and the defendant whereby the company were manufacturing under those licences. The receiver took no steps to terminate the licences; they went on for the life of the patent, subject to the company giving three months' notice.

Mr. Blackwell did not agree.

Mr. Fortune said the Receiver did not do that, and he sent out a notice wherein he said he was going to carry on the company as usual.

Mr. Blackwell added that the company went into liquidation on April 22nd, 1913. The company's business came to an end, except for the purpose of realising the assets of the company for the debenture holders. There was no contract continuing. There was no grant of improvements or modifications to the company.

Mr. Fortune: The company were manufacturing with a view to selling to the Igranic Co.

Mr. Blackwell: Not after the liquidation.

Mr. Fortune: Oh, yes.

Mr. Blackwell thought that if agreements which were made covered the new patents which were entered into, inasmuch as the company, during the time of the Receiver, did manufacture and sell on plaintiff's evidence under the new patents, the defendant might, be able to maintain a counter-claim against the plaintiffs.

Mr. Fortune said that Hardy could have repudiated the licence, but he sat on it, and therefore he had to pay the dead royalties, even if he never manufactured at all under it. He did not mind whether Hardy was acting for the Adams Manufacturing Co., or for Bacon, or for the Igranic Co. Defendant was entitled to £50 a year for 15 months, or £62 10s. from April 11th, 1913, to September, 1914.

Mr. Blackwell replied that the receiver and manager was neither a successor nor the assignee of any contract with the company. He did not come within the words of the contract at all.

Judge Rentoul: Could he repudiate it?

Mr. Blackwell: Yes, in the sense that he could say "I am not going to express my willingness to take over the contract;" but he is under no obligation to repudiate, because it is not a contract which is binding upon him. It is a breach of contract on the part of the company in not carrying out the agreement. They had failed by selling and manufacturing or by omitting to pay the dead royalty. Mr. Blackwell added that every one thought the Igranic Co. would take over the patents, but they did not do so.

Judge Rentoul gave judgment for the plaintiffs on the claim for £43 and costs, and for defendant on the counter-claim for £62 and costs.

BUSINESS NOTES.

Catalogues and Lists. — British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester. — A number of new publications giving descriptive particulars and illustrations, and, in most cases, prices, of a variety of electrical manufactures, as follows:—

No. A56/A1.—Type EA oil-immersed auto-starters for squirrel-cage motors.
No. A56/B1.—Type MF rotor starters for A.C. slip-ring motors.
No. A56/C1.—Type D starters for D.C. motors.
Nos. L358/2-1 and L358/2-3.—A.C. single-phase watt-hour meters, type N.
No. L358/2-4.—Performance curves, and diagrams of connections, of type N single-phase watt-hour meters.
No. 312/3.—Horn type switch fuses.
No. 47/3.—Brake solenoids for single-phase connections.
No. 47/4.—Brake solenoids for three-phase circuits.
No. 322/2A.—Knife switches for low and medium-pressure switches, type B.
No. 7,703/1.—Westinghouse motor applications: Notes on the electrification of a modern flour mill.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham. —List No. 627, illustrating and giving prices of several designs of inspection lamps for shells and other articles such as casks, carboys, &c., where interiors can only be inspected through small apertures. The largest design shown is for the inspection of the interior of hogsheads, and it is fitted with a spigot for removing stray corks. The smallest lamp shown is designed for the inspection of 18-pounder shells or other small work. Some of the lamps are fitted with small switches in the handles; some are without switches, whilst one specially robust type for munitions work is fitted with a standard tumbler switch in a convenient position near the handle. All the fittings are sent out complete with lamps and flexible, with earth-wire connected.

Messrs. Meldrums, Ltd., Timperley, Manchester. — 20-page illustrated catalogue of the Meldrum forced-draught furnace, with a host of extracts from tributes paid thereto by users in all departments of industry.

For Sale.—The Postmaster-General has for disposal, and is open to receive offers for, a quantity of surplus stores. The Corporation of Accrington Electrical Engineering Department invites tenders for one 175-kw., 460-D.C., direct-coupled generating set, and three 56-kw., 230-volt, D.C. Willans-Johnson & Phillips sets. Particulars are given in our advertisement pages to-day.

Temperature Measurement.—During the past month the CAMBRIDGE SCIENTIFIC INSTRUMENT CO. have received contracts for temperature measuring instruments for various Home Government departments, also for the Victorian Government Railways, the Small Arms Factory—Lithgow, Australasia, and the Russian Government Supply Committee.

Australian Imports.—We have received from the Australian Association of British Manufacturers and their Representatives at Melbourne a copy of their statistical statement of competitive imports into the Commonwealth of Australia for the 12 months ended June 30th, 1915. The statement has been compiled differently from those previously issued, as it is considered that it will be of more value to give the totals and values of goods imported into the Commonwealth under preferential and non-preferential tariff rates, than to show the percentages of imports into each separate State from the United Kingdom. Further, as imports from Germany have now disappeared, figures are shown for imports from British Dominions and Possessions and the United States of America, as well as the United Kingdom.

The United Kingdom share of the Commonwealth imports of competitive manufactured merchandise (1914-15) was 64·9 per cent. We make the following extracts :—

IMPORTS FROM ALL COUNTRIES (1914-15).

CLASS.	Total.	Preference.	Non-Pref.
Metals—Manufactured	£9,441,123	£9,422,708	£18,415
,, Machinery	3,806,100	3,806,100	—
,, Miscellaneous manufactured	2,886,608	2,886,593	15
,, Bars, rods, blooms	933,594	933,594	—
,, Pig and ingot	258,167	241,555	16,612
India-rubber, and manufactures of ..	481,811	481,811	—
Instruments, scientific, surgical, &c.	543,463	388,384	155,079

ANALYSIS OF IMPORTS, 1914-15.

CLASS.	UNITED KINGDOM. Total.		Preference.		Non-Pref.		BRITISH DOMINIONS & POSSESSIONS. Total.		Preference.		Non-Pref.		UNITED STATES. Total.		Preference.		Non-Pref.	
	£	%	£	%	£	%	£	%	£	%	£	%	£	%	£	%	£	%
Metals—Manufactured	6,789,184	71·9	6,787,503	72·0	1,681	8·8	306,224	3·2	306,224	3·2	—	—	1,717,099	18·1	1,710,204	18·1	6,895	37·4
,, Machinery	1,988,409	52·2	1,988,409	52·2	—	—	122,279	3·2	122,279	3·2	—	—	1,446,744	37·9	1,446,744	37·9	—	—
,, Miscellaneous manufactured ..	1,691,957	58·6	1,691,957	58·6	—	—	241,147	8·3	241,147	8·3	—	—	715,639	24·7	715,624	24·7	15	—
,, Bars, rods, blooms	728,672	78·0	728,672	78·0	—	—	4,693	·5	4,693	·5	—	—	115,837	12·4	115,837	12·4	—	—
,, Pig and ingot	162,176	62·8	152,357	63·0	9,819	59·1	59,013	22·8	58,150	24·0	863	5·1	25,830	10·0	21,074	8·7	4,756	28·6
India-rubber—and Manufactures of	214,929	44·6	214,929	44·6	—	—	36,703	7·6	36,703	7·6	—	—	118,669	24·6	118,669	24·6	—	—
Instruments—Scientific, surgical, &c. ..	257,051	47·2	182,994	47·1	74,057	47·7	3,610	·6	3,021	·7	589	·3	220,813	40·6	156,739	40·3	64,074	41·3

A copy of the annual report of the Association for 1915 is also before us. It shows that the number of members has increased by 35 to 270, of whom 134 are British manufacturers and 136 representatives of British manufacturers. The principal subject referred to is that of the Federal Income-Tax, a new tax to be imposed in addition to those previously in existence.

"The Federal Act imposes a tax on persons selling goods in Australia on account of persons not resident in Australia, or on account of companies not registered in Australia, and lays down that the principal shall be deemed to have derived from such sales a taxable income of 5 per cent. upon the price at which the goods were sold. The person selling the goods is made personally liable for the payment of the tax if he disposes of or parts with any fund or money out of which the tax could legally be paid. An amending Bill was later introduced which provided that goods shall be deemed to be sold in Australia on account of a person not resident in Australia or of a company not registered in Australia if any person in Australia receives a commission in respect of the sale of the goods or is paid a salary for obtaining orders for, or for influencing the sale of, the goods. During the passage of this amending Bill through the House, your Executive Council waited on the Secretary to the Prime Minister as a deputation, and protested against the unfairness of these provisions, pointing out that the British manufacturer who is sufficiently progressive to have an agent or representative in Australia who employs labour, pays taxes and generally contributes to the welfare of the country, would have to pay this tax on all business done by or influenced through his agent or representative, while the British manufacturer who is content to merely sell to some London merchant or to people in Australia by means of distributing catalogues through the post, would entirely escape taxation, and would thereby obtain a trade advantage over his more progressive competitor. Further, the fact that British Manufacturers require every assistance at the present time was accentuated, and that they already have to pay very heavy British Income-Tax on the profit on all goods manufactured at their works, whether sold at home or exported overseas. . . . The Prime Minister insisted that as the whole purpose of the Act is to obtain revenue, he could not agree to sacrifice that which would be levied under the provisions to which exception was taken, but after a lengthy debate he finally agreed to an amendment which exempts the agent from personal liability in respect of business done before June 30th, 1915, and also confines such personal liability to tax in respect of goods sold by the agent. The Prime Minister further undertook that the subject would be brought up by the Government for further consideration before the provisions as to the personal liability of agents come into operation, so that the matter will be discussed again by the House when the rates for next year are fixed probably about April or May, 1916."

The Executive Council of the Association have again placed their views before the Federal Government in writing, and have lodged an application for a date to be appointed for a deputation of members of the Association to wait on the Treasurer.

The Executive Council have on several occasions had before them suggestions that some steps should be taken to prevent enemy countries regaining trade which they have lost on account of the war, but as this is a matter so much bound up with questions of tariff, national treaties and future, discussion of terms of peace, they have found it difficult to formulate any definite proposals. The following resolution was unanimously adopted and copies have been forwarded to the Prime Minister, the Attorney-General and the Minister of Trade and Customs, and also published in the Press :—

That the Executive Council of the Australian Association of British Manufacturers and their representatives, bearing in mind the fact that countries at present at war with the British Empire are certain to make strenuous efforts to recapture trade which they have lost during the war, wish to impress on the Government of the Commonwealth of Australia the necessity of taking such steps as will absolutely prevent the importation of German and Austrian goods after the declaration of peace.

The Association has strongly urged the necessity of the British Government and British financiers, stipulating in regard to all future loans granted to, or underwritten for, Colonial Governments, that all money loaned must be spent within the Empire, and not, as has so frequently been done in the past, paid away to foreign firms.

The policy of the Association in endeavouring to obtain preferential treatment for goods of British manufacture has been persistently pushed on every possible occasion. The Cabinet of the New South Wales Government has decided that a 10 per cent. preference shall be extended to goods or material of local, British or Empire manufacture as against those of other countries. It was also decided that such margin of preference shall be inclusive of any preferential Customs duty that may obtain in the case of the particular material affected. All Government departments and corporate bodies operating under the ægis of the Government have been asked to give effect to this policy forthwith.

Electrical Trade in the Caucasus.—H.M. Consul at Batoum says that the electrical trade is a branch of British industry that might very profitably be developed in the Caucasus. Until the outbreak of war, and for some time after, the electrical engineering appliances and materials required locally came principally from Germany. If the intention to capture German trade under this head is to be realised, British manufacturers should take advantage of the present opportunity to prepare for the competition that will exist after the war. The needs of the Caucasus in all manner of electrical appliances from the smallest to the largest are indeed very great, and when normal conditions are resumed there is no reason whatsoever why British sources of supply should not be preferred to those of Germany. The quality of the articles produced in the United Kingdom is admitted in the Caucasus to be superior to that of German-made goods, but the question of price will have to be studied closely together with that of the terms of payment. In March this year most supplies were almost exhausted. The Consul says that if we are to successfully compete with German firms our manufacturers should enter the field now, if only for the purpose of making preliminary arrangements. Our travellers should speak Russian, and carry Russian price lists, with prices worked out in roubles at the current rate of exchange. Manufacturers of other countries are very alert just now in the Russian markets.

Trade with Serbia.—Dr. Svotosar Groich, speaking on Anglo-Serbian economic and political relations, at the London Chamber of Commerce, said that by freeing herself from the control of the Central Powers, Serbia would have to solve a very important and difficult economic problem, and she hoped and expected that England would give her adequate assistance in this work. British commercial influence in Serbia had hitherto been far too inadequate. The radical changes of conditions after the war, and the acquisition of direct commercial communication by sea, would enable England to occupy the predominant position hitherto held by the Central Powers in Serbia. To encourage Anglo-Serbian trade, it was necessary to organise a few Anglo-Serbian commercial and industrial syndicates of well-known and experienced business men of both nations.—*Times.*

Dissolutions and Liquidations.—BERNERS ELECTRIC CO., electrical engineers and contractors, 55, Berners Street, London, W.—Messrs. C. J. Heffer & F. E. Bayley, have dissolved partnership. Debts will be attended to by the Berners Electric Co.

CEDES ELECTRIC TRACTION, LTD., London.—First meetings of creditors and contributories, May 19th, at Carey Street, W.C.

M. & G. TRUCK AND ENGINEERING CO., LTD.—This Company is winding up voluntarily with Mr. C. Cooper, 30, Moorgate Street, E.C., as liquidator. A meeting of creditors is called for May 17th, at 14, Old Jewry Chambers, E.C.

ARDWICK ELECTRIC REGULATOR CO., LTD.—A meeting is called for June 9th, at 67, Princess Street, Manchester, to hear an account of the winding up from the liquidator, Mr. J. W. Shepherd.

Bankruptcy Proceedings.—W. C. WILD, electrical engineer, Halifax.—Trustee (Mr. W. Durrance), released May 5th.

Trade Announcement.—Owing to increasing searchlight work and lamp-lowering gear business the LONDON ELECTRIC FIRM, of Croydon, require additional space, and they are building a new works at Brighton Road, Croydon.

Electrical Imports to the Argentine Republic.—According to a recent official return, the imports of electrical goods into the Argentine Republic, during last year, only attained a value of £751,000, as contrasted with £1,405,000 in 1914.

Book Notices.—*The Exporter's Handbook and Glossary.* By F. M. Dudeney. London: Sir Isaac Pitman & Sons. 5s. net.—The author had begun his work before the outbreak of war, and he has adhered to his original plan of preparing a permanent handbook to the export trade, resisting the temptation to point the commercial lessons of the war, about which so many other authorities are writing and speaking to-day. The book is intended to give an exposition of the principles and methods of export business which will assist British manufacturers and merchants who determine to secure a larger share of the world's trade. It consists of some 40 chapters, a glossary of abbreviations and terms used in export trade, and inset there are many useful specimen shipping documents, such as advice notes, bills of exchange, bills of lading, Consular invoices for different countries, Customs specifications, certificates of origin, a marine insurance policy, and so forth. It is an instructive and educative work throughout, and should be valuable to exporting firms and their employés, especially at a time when it is recognised that there is room for improvement in the commercial training of the younger generation who will have to play a large part in the maintenance and extension of our Colonial and foreign trade after the war. Among the matters dealt with in the course of its 40 chapters are:—The advantages and general principles of export trade; the indent; types of overseas importers; the native importer; the merchant shipper; the export agent; manufacturers' oversea representatives; travelling representatives; export advertising; a summary of methods to be followed in order to secure export trade. The author proceeds in the second part to discuss and describe such matters as financial machinery, bills of exchange, credits and terms of payment, and in Section 3 he tells how to quote to oversea buyers, how to prepare export catalogues, emphasises the wisdom of giving metric equivalents in all quotations, classifies the weights and measures systems of different countries, and handles such points as sampling, packing, marking, and methods of shipment. In the fourth section the subjects covered include freight, bills of lading, demurrage, marine insurance, Consular invoices and certificates of origin, Customs requirements, consignors' and consignees' liability, &c. In several places the author refers to the important part which must be played in certain markets by the technical representative who is able to supplement the efforts of the commercial or sales representative, especially in connection with mining and electrical machinery and other engineering classes of exports. He appreciates the importance of adequately compensating the right man, a direction in which British manufacturers have, unfortunately, played too often into the hands of the Germans in past days. One of the most interesting chapters in the book, so far as we are concerned, is that in which emphasis is laid upon the great part which must be contributed by reputable export trade journals. The author says that the solid basis of any general export advertising campaign must be the specialised export trade journal—systematically reaching oversea buyers who can be got at in no other way. He remarks that there are comparatively few, even of these, which can honestly claim effectually to fulfil their purpose, but those which really do offer sound value for the advertiser's money, are undoubtedly among the most potent levers available for creating and extending export connections. He proceeds to remark that figures of circulation are not to be regarded as the gauge of value in regard to the more respectable export publications. These often refuse to divulge such figures, knowing that the true test is quality rather than quantity, "which latter any mushroom print can guarantee, and even provide, without the advertiser being one jot the better for it." "The only circulation worth considering is that which covers the *bonâ fide* wholesale importers in a given market or markets." Elsewhere, in discussing the want of co-operation between commerce and finance in pursuit of export business, he advocates an adaptation of our present system to the needs of the times. There is a chapter on "How the Government Helps Manufacturers in which the part played by the Board of Trade in placing export trade information at traders' disposal is more fairly dealt with than is sometimes the case. From the foregoing summary of the contents it will be observed how complete a work on the subject Mr. Dudeney has set himself to produce. He has brought together a vast amount of most useful information in a very well-arranged form, and the book deserves, and, no doubt, will have, a ready sale among the commercial community.

"*Proceedings* of the Physical Society." Vol. XXVIII, Part 3. April 15th, 1916. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

Telegraph and Telephone Journal. Vol. II, No. 20. May, 1916. London; G P.O. North, the Editing Committee. Price 3d.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXV, No. 4. April, 1916. New York; The Institute. Price $1.

"Science Abstracts." A. and B. Vol. XIX, Part 4. April 25th, 1916. London: E & F. N. Spon, Ltd. Price 1s. 6d. each net.

"Mechanical Engineers' Pocket Book." By W. Kent. London: Chapman & Hall. Price 21s. net.

"Anglo-Russian Trade: Exposure of the Russian Chamber of Commerce in London." London: *Daily Chronicle* Office. Price 6d.

The French Exporter is a new monthly journal for the "defence and the expansion of French interests." It will appear separately in the English and French languages. A number of interesting illustrated articles on such matters as the Lyons Fair, the Economic Conference, French automobile and carriage trade, &c., appear in the April number, a copy of which is before us. Price 1 fr. per copy; published at 24, Boulevard des Italiens, Paris.

International Company Law.—According to the *Manchester Guardian*, Sir John S. Randles, M.P., chairman of the Commercial Committee of the House of Commons, moved at the Congress, in Paris, of the Commercial Committees of the Allies' Parliaments: "That a reform of company law amongst the Allied nations is very desirable, with a view to enable business men of the Allied countries to buy and sell more freely." Money, said Sir John, lacked nationality; it went where it could find a congenial and profitable field. While money, however, was cosmopolitan, national boundaries remained, and a company was often under two jurisdictions, with an inevitable conflict of laws. The moment was ripe for the enunciation of an agreement upon leading principles of joint-stock company law such as could be accepted by virtually all European nations, and would be of incalculable convenience to all who were engaged in company enterprise, in addition to affording an inestimable stimulus to the investment of further active funds in this form of enterprise.

LIGHTING AND POWER NOTES.

Accrington.—YEAR'S WORKING.—There was a loss of £3,410 on the working of the Council's electricity undertaking during the past year, as against £3,670 in the previous year. The income was £35,247, and the expenditure £38,657.

The Tramways and Electricity Committee has decided to enter into a five years' agreement for an additional supply of current to the Calico Printers' Association.

Australia.—HYDRO-ELECTRIC SCHEMES.—A series of proposals for the generation of electric power by the utilisation of waterfalls in various parts of New South Wales is to be submitted by the Government to the Public Works Committee. The principal proposal is in connection with the overflow from the Burrinjuck dam, and would cost about £100,000; it would provide power and light in many towns and districts.

The Upper Clarence River would provide a hydro-electric scheme at a cost of £25,000.

The schemes have been tentatively recommended by engineers as the result of inquiries set on foot by the Government about 18 months ago.

The Sydney City Council, on May 1st, commenced the supply of electricity to Lane Cove (North Sydney) Municipal Council.

Additional plant is being installed in the rolling mill of the steel works of the Broken Hill Proprietary Co., Ltd., at Newcastle, N.S.W., and, in order to supply the necessary power, a further 1,000-KW. set is being added to the electrical generating plant.

Belfast.—YEAR'S WORKING.—For the year ended March 31st the net profit on the Corporation electricity undertaking—according to the *Northern Whig*—was £17,000, this being a record. The highest previous surplus was £13,175. The total receipts were, roughly, £115,000, and the expenditure amounted to £68,579. The output sold for lighting and power, exclusive of tramways supply, was 9,149,000 units, as against 8,193,000 units in the previous year; the tramways supply was 3½ per cent. less than in 1914-15. The excellent result is attributed to the growing power supply, coupled with the recent increase in price.

Blackpool.—ANNUAL ESTIMATES.—The electricity department's estimated income for the present year is £46,200, and the expenditure £26,925. Gross profit is estimated at £19,275, but capital charges will absorb £17,275, leaving an estimated surplus of £2,000, as compared with a surplus for the year just closed of £2,478. The estimated receipts are up by nearly £2,000. During the last three years there have been 1,028 new consumers.

Bootle.—PRICE INCREASE.—As from June 30th next, 12½ per cent. is to be added to the charges for electricity for lighting, power, and other purposes, except in cases where special agreements limiting the charges for electricity exist.

Bo'ness.—LOAN SANCTION.—The T.C. has been notified by the Secretary for Scotland that he is prepared to sanction the borrowing of an additional sum of £12,000 for the extension of the electricity undertaking, subject to the condition that one-twentieth of any sums borrowed under the sanction is paid off, or set aside, to a sinking fund annually. The Council has approved of the terms of the letter, and has agreed to ask the National Electrical Construction Co. to submit the particulars of the modified scheme, with estimates, for the acceptance of the Council.

Bury.—YEAR'S WORKING.—The profit for the past year on the Corporation electricity undertaking was £2,003, £1,000 of which is to go to the relief of the rates, and the balance to the reserve fund.

Carnarvon.—LOAN SANCTION.—The T.C. has received the sanction of the L.G.B. to the borrowing of £2,680 for additional plant at the electricity works.

Chile.—A decree has been issued granting permission to Don Horacio Urrutia Gundian to install electric light and power systems in the towns of Illapel, Salamanca, and Vicuna.—*Board of Trade Journal.*

Continental.—SWITZERLAND. — An influential Swiss electrical concern is the Columbus Electrical Society, formed some years ago at Glarus. It is associated with the Brown-Boveri group and possesses 75 per cent. of the capital of the Italo-Argentine Electrical Co., of Buenos Aires, which enjoys a concession similar to that of the Deutsche Ubersee Elektricitäts Gesellschaft, and has secured a number of private, municipal and State contracts. The Italo-Argentine Co. holds the majority of the shares in the electrical companies in the Argentine cities of Dolores, Courientes, and Pergamino.

Cumberland.—The C.C. has granted the Cumberland Waste Heat Owners' Co. permission to cross the Whitehaven, Egremont, and Cleaton Moor, and Egremont Main roads with electric cables, provided they are placed underground. Objection was taken to overhead lines on the ground of danger to the public in rough weather.

Dartford.—INCREASED ASSESSMENT.—The Assessment Committee has increased the assessment of the electricity undertaking from £450, rateable value, to £1,700, and the refuse destructor from £166 to £300. Notice of objection has been lodged.

Greenock.—PLANT INAUGURATION.—Last week, a new 5,000-KW. Westinghouse-Rateau turbine set was started up at the Dellingburn power station, this being a duplicate of the one installed two years ago. The alternator is of the totally enclosed self-ventilated type with compensating windings. In the course of some remarks at the inauguration ceremony the convener mentioned that the output of the works in 1913-14 was 11,000,000 units, while it was expected that the present financial year would show an output of considerably over 20,000,000 units.

Horwich.—The U.D.C. has consented to the Bolton T.C. supplying energy to a consumer in the urban area, on condition that other applicants will be supplied.

Hove.—WAR BONUSES.—As a result of a petition from the employés of the Corporation electricity department, it has been decided to grant various members of the staff an extra war bonus of 3s., in addition to the present bonus of 2s. per week.—*Sussex Daily News.*

India.—ALL-ELECTRIC COLLIERY.—The Burelia Colliery of Messrs. Bird & Co. is the only entirely electrical colliery in India. Two groups of two shafts have been sunk, the power being supplied from a station at the Chichuria pits equipped with two 300-H.P. Belliss-Siemens generating sets. Four similar electric winding engines are installed, each driven by a 25-H.P., 500-R.P.M. motor, and having a capacity of 200 tons in eight hours, using single 15 cwt. tub cages. One pump is installed at each dip shaft with a capacity of 6,000 gallons an hour against a head of 320 ft. Four additional three-throw dip pumps on trolleys are also in use. Two Turbon fans are to be installed, one at Chichuria and one at Dahooka.

A ropeway in two sections is provided, to connect the two collieries with the screens, and this is driven by a 60-H.P. motor.

Llanfyllin.—Mr. R. A. Jones, who has completed an E.L. installation for the town, has offered to undertake the public lighting at £2 per lamp per annum. This, compared with the present cost of gas lighting, will ensure an annual saving of £30. The T.C. has decided to consider the matter at a special meeting.

London.—HAMMERSMITH.—The Electricity Committee recommends the Council to conclude an agreement with the Osram-Robertson Lamp Works, Ltd., for a supply of electricity to Brook Green Works for a period of four years from April 1st, 1916, and afterwards, subject to determination by six months' notice, at 8d. per unit. The minimum guaranteed payment to be £5,000 per annum, representing 1,500,000 units.

FULHAM.—Owing to the difficulty of obtaining adequate supplies of water from the river for condensing purposes in connection with the Council's electricity undertaking, owing to low tides and other causes, the Electricity Committee recommends that the circulating water pipes be extended further into the river, at an estimated cost of £1,500. The work can only be carried out during the summer.

BATTERSEA.—Owing to the increase in the demand for electricity in the Nine Elms and Church Road districts, the Electricity Committee recommends the adoption of the scheme of the electrical engineer providing for a sub-station at Nine Elms, with a rotary converter, which, with mains, will cost £3,723; also for additional transformer and switchgear in the New Road sub-station, at a cost of £875, and an additional feeder cable at a cost of £780.

On Wednesday, last week, an inquiry, lasting six hours, was held into the application of the Charing Cross Electricity Co. to be allowed to increase its statutory charges during the war. The City Corporation, the L.C.C., the Port of London Authority, and about 30 private consumers appeared to oppose the application.—*City Press.*

BETHNAL GREEN.—The B.C. has given notice to the Stepney B.C. of the commencement shortly of the supply of electricity in Bethnal Green.

Middlesbrough.—BULK SUPPLY.—The Cleveland and Durham County Electric Power Co. has approached the Corporation with a view to advancing the price of energy temporarily by 15 per cent., as from January 1st, 1916, until six months after the termination of the war. The matter has been left with a Sub-Committee pending a proposed meeting of the principal consumers of the Power Co.

Middleton.—PRICE INCREASE.—The charge for electricity for lighting has been increased by ½d. per unit, and for power purposes by 12½ per cent.

Newcastle-under-Lyme.—PRICE INCREASE.—Owing to the high price of fuel, the T.C. has increased the tariff for general electrical lighting by 5 per cent.; for power, by 16⅔d. per cent; cinemas, increase of 10 per cent. on lighting, and of 20 per cent. on power; North Staffs. Railway Co., increase of 20 per cent. on power; Messrs. Hammond's mills, increase of 10 per cent. on power.

Rochdale.—PROPOSED LOAN.—The Gas and Electricity Committee has recommended that application be made to the L.G.B. for sanction to borrow £60,900 for extensions to buildings and plant at the electricity works. The T.C. has decided to call a special meeting to discuss the matter.

Salford.—BULK SUPPLY. — The Council last week adopted a recommendation of the Electricity Committee varying a resolution of February last relative to the supply of electricity in bulk, by agreeing not to require the Lancashire Electric Power Co. to supply a demand of over 2,000 KW. unless the company has the necessary plant available, and subject to reasonable notice being given by the Corporation.

South Africa.—The Boksburg T.C. has had under consideration an offer from the Victoria Falls Power Co. to supply the town with electricity under a 15 years' contract. Apparently the town has spent £13,000 on electric plant and buildings, and, if the offer is accepted, it will be necessary to dispose of the plant at an estimated loss of £4,300; it will also be necessary to spend £500 in connection with the proposed supply; assuming that the proposed supply costs an average of 1·25d. per unit, the addition of financial charges on the amounts above mentioned would bring the cost to 1·43d. per unit.

South Lancashire.—A correspondent informs us that the completion of the equipment of the Hulton Colliery Co.'s new pits at Huyton is being hindered by the difficulty in obtaining delivery of the equipment for the electric winders which are to be installed.

Torquay.—The Corporation Electric Light Committee has deferred consideration of the proposed increase in the price of current to the Tramway Co. until the expiration of the company's year of account in August next.

Walkden.—A new generating station has been completed at Lord Ellesmere's Mosley Common Collieries, in which exhaust steam turbine and air-compressing plant is installed; generating stations have also been erected at the Bridgewater and Ashton Field collieries.

Warrington.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £9,536 for extra boilers at the electricity works, and has authorised the work to be put in hand.

Wigan. — PROPOSED EXTENSIONS. — The T.C. has adopted a scheme of electrical extensions based on the recommendation of Mr. H. Dickinson, city electrical engineer of Liverpool. Application is to be made to the L.G.B. for sanction to the borrowing of £53,920 in connection with the proposal, which involves the installation of new boilers, turbine plant, &c.

Wolverhampton.—LOAN SANCTIONS. — The L.G.B. has sanctioned the borrowing by the Corporation of £4 000 for the laying of mains and £2,000 for sub-station equipment in connection with the electricity undertaking. The Electricity Committee has entered into an agreement to supply the works of Arcorundum Abrasives, Ltd.

TRAMWAY and RAILWAY NOTES.

Accrington.—The last year's accounts of the Corporation tramways show total receipts amounting to £29,393, compared with £27,850, and working expenses amounting to £19,498, against £16,438 in the previous year. The passengers carried totalled 4,841,334; the traffic revenue per car-mile was 12·86d., and the working expenses 8·67d.

Bacup.—Representatives of the Bacup Tramways Committee and the Rawtenstall Corporation are to meet to discuss questions relating to tramway stages and fares, upon the suggestion of the Rawtenstall Corporation.

The Corporation has approved draft tramway rules and regulations, as amended by the L.G.B.

Belfast.—Year's Working.—At the quarterly meeting of the Corporation the annual statement of the tramway accounts, the details of which were given in these notes last week, was approved of after much criticism. Councillor Duff said that he did not think that a surplus of £5,000, was enough when other systems gave from £50,000 to £70,000.

Birkenhead. — Female Labour. — Some criticism having been made recently regarding the work of the women car conductors, Mr. Halsall (chairman of the Tramways Committee), made a statement at a meeting of the T.C., on May 3rd, to the effect that the women were doing their duty very satisfactorily. Inspectors had been specially employed checking the women conductors' pay-sheets on the routes during the hours of the heaviest traffic, and it was found that very few fares had been missed on the cars. The management were satisfied with the work of the conductors.

Blackpool.—The Easter traffic returns on the Corporation tramways were remarkable. They were only £100 short of an absolute record, being £3,380, as compared with £3,480 in 1914, which was £800 better than any preceding year in the history of the department.

A statement has been prepared showing estimated receipts on the tramways for next year of £76,000, and expenditure amounting to £46,200, leaving a gross profit of £29,800. Capital charges will absorb £19,800, leaving an estimated surplus of £10,000. For the year just closed the estimated surplus was only £2,500, but the actual surplus was £16,500.

Bolton.—Electric Vehicles.—The T.C. has agreed to a recommendation of the Electricity Committee that an electric charging station for battery vehicles be installed at Spa Road works; also that the attention of the various Committees of the Corporation using vehicles be drawn to the enormous advantages to be gained by substituting electric vehicles for other types, and that a deputation from the Electricity Committee confer with those Committees on the subject.

Bradford.—Electric Vehicles.—The Electricity Committee proposes to purchase an electric battery vehicle for conveying coal from the railway yards to the electricity works, and ashes from the works to available tips. The authorities will be able to compare the advantages of this vehicle with the railless trolley 10-ton conveyance which the tramway department has put on the streets to help local industries to overcome transit difficulties.

The *Sheffield Independent* states that the new vehicle on the railless trolley system, which is to inaugurate a service of goods haulage on the tramways made its appearance on Monday last; it took a 2-ton load to Wibsey, running at the speed of an ordinary tramcar when in touch with the overhead wires, and at the same time accumulating power for use when leaving the tramway routes. It will be regularly used for the purpose of conveying wool from railway depôts to the various warehouses in the city, and will greatly ease the strain caused by the shortage of ordinary cartage facilities.

Dublin.—Gangs of men are making good the damage caused by the rebel outbreak of Easter week. The damage done to the tramway system appears to have been exaggerated, as by the end of last week the power station and the distributing stations were virtually working as usual. Some damage was done to the rolling stock, as some of the cars were seized by the rebels to form parts of street barricades. The electric lighting, &c., in Sackville Street is, of course, badly damaged owing to the havoc wrought by the rebels, fires, and the artillery bombardment.

The Dublin and Lucan Electric Railway, notwithstanding the danger prevalent in the neighbourhood of Conyngham Road, was able to maintain a complete service of cars. The manager reports that during one period, hundreds of bullets passed over the company's buildings, though no material damage was done.

Gateshead-on-Tyne.—The question of paving in connection with the tramway doubling on the Bensham route is being discussed by the T.C. and the Tramway Co., the latter disagreeing with the Council's requirement that it shall pave margins at the road side.

Glasgow.—The receipts from the Corporation tramways last week totalled £23,152, which is the highest amount yet received during a normal week.

The Sub-Committee on Tramways Finance has agreed to recommend that the depreciation for the current year be at the same rates as for the preceding 12 months.

The Tramways Committee has decided to recommend that the works and properties of the department be insured against aircraft risks.

Halifax.—The Tramways and Electricity Committee has been authorised by the Council to carry out extensions at the Skircoat depôt, at an estimated cost of £2,700.

Nottingham.—The Corporation tramways, gas, and electricity undertakings have contributed £60,350 this year to the relief of rates, as compared with £71,000 last year.

Salford.—Year's Working.—At a meeting of the T.C. last week, Ald. Linsley, chairman of the Tramways Committee, said the Committee had a net balance of £18,000 on the year's working of the tramways, and it was proposed to borrow £4,000 from the reserve fund in order to contribute £22,000 to the relief of the rates.

Stretford.—The U.D.C. is applying to the B. of T. for an extension of time for the completion of the construction of lines authorised by the Stretford Light Railways Order, 1906, and the West Manchester (New Lines, &c.), Order, 1906.

Sheffield.—The Corporation tramway receipts during the Easter holidays totalled £11,439, an increase of nearly £3,000 as compared with the previous year.

U.S.A. — The Brooklyn Rapid Transit System has recently introduced an articulated car made up of two single-truck cars and a low floor vestibule for its street lines. This type of car is really of an experimental character, and data as to its working will be collected over a number of lines. The complete car is 62 ft. 10 in. overall, comprising the centre vestibule 13 ft. long, two car bodies each 20 ft. long, and two end platforms each 4 ft. 10 in. long. The car is fitted with a motor-driven coin register in the centre entrance vestibule, and the latter is provided with pneumatically-operated doors.

Chicago-Milwaukee Electrification.—The Chicago, Milwaukee and St. Paul Railway was expecting to inaugurate electrical operation on the second section of its electrified district about April 15th. The road has been operated electrically since last December between Three Forks and Deer Lodge, Mont., a distance of 115 miles, and the new electrified section comprises that part of the road between Harlowtown, Mont., and Three Forks, a distance of about 113 miles. This will make a continuous piece of electrified railroad for both heavy freight and passenger service for a total distance of some 228 miles.

The new electrical equipment having been in service throughout the winter months, Mr. C. A. Goodnow, assistant to the President, has authorised the statement that the results of the electrification have in every way exceeded their expectations. At times when the severe cold weather was seriously impeding operation by steam the electric locomotives were moving without any trouble. The new equipment has given satisfaction not only with respect to tonnage handled and the mileage made, but also with respect to regularity of operation and freedom from failures. One electric locomotive is taking the place of four steam engines and promises eventually, at full efficiency, to supplant even a larger proportion of steam locomotive power. Moreover, the electric locomotive handles its full tonnage at 15 to 16 miles per hour as against 8 or 9 miles per hour by steam. The mileage of the heavy trains drawn by electric locomotives is 200 in 24 hours, which compares with 114 miles by steam locomotives. On the 115 miles now operated electrically, 24 steam locomotives, Mallet and other heavy types, have been released already by the nine electric locomotives which are now in service, and the trains are moved more quickly and cheaply. The maximum loads will be 3,000 tons over the mountains, 3,450 tons between Deer Lodge and the mountains, and 4,500 tons between Bitter Root mountains and Deer Lodge. These trains will be handled with one engine except for short stretches where a helper will be used. A rough estimate is made at present that repair costs on the electric locomotives will amount to about one-half the expense of the steam locomotive. The regenerating braking feature is working as satisfactorily as are other features of the equipment. It is possible to dispense with the air brake entirely in ordinary operating, thus avoiding heating and possibly broken wheels, and the excessive wear of brake shoes, with a stopping of the freight trains every 10 or 12 miles to cool wheels.—*Railway Review.*

Wigan.—Year's Working.—There was a profit on the past year's working of the Corporation tramways of £663.

TELEGRAPH and TELEPHONE NOTES.

Dublin.—During the recent rising in Ireland, the rebels neglected to cut the Stock Exchange telephone wires; had that been done, Dublin would have been isolated and the troops at the Curragh would not have been warned in time. Fortunately, some of the military got to the Exchange on Easter Monday in time to protect it, arriving exactly three minutes before the rebels came to cut the connection.

Telephone for Forest Rangers.—A portable telephone, made of aluminium and weighing only 2·5 lb., the invention of a U.S. forest officer, R. B. Adams, will be part of the regular equipment of patrolmen in the U.S. National Forests during the coming season; it is regarded as a great improvement over the set formerly used, which weighed 10 lb. A field man equipped with this telephone, a few yards of light emergency wire, and a short piece of heavy wire to make the ground connection, can cut in anywhere along the 20,000 miles of Forest Service telephone lines and get in touch with the headquarters of a supervisor or district ranger.—*Electrical Review and Western Electrician.*

Trans-Atlantic Wireless Telegraphy. — Marconi's Wireless Telegraph Co., Ltd., announces the resumption of the deferred night and week-end letter services, which were suspended recently owing to the trouble in Ireland, and their traffic can now be expeditiously handled, as their land-line communication with the high-power trans-Atlantic wireless station in Ireland is restored.

Wireless Telephony.—Mr. Daniels, Secretary of the United States Navy, has communicated, by means of a wireless telephone, with the commander of a battleship off the coast. This is the first time communication by wireless telephone between ship and shore has been established.—*The Times.*

Wireless on Aeroplanes.—According to the *Daily Express*, Mr. Marconi has succeeded in developing apparatus which makes it possible not only to transmit wireless messages, but also to receive them on aeroplanes, besides improving the reception on airships; he stated that the improvement would make wireless communication more efficient, and would make it more difficult for the enemy to intercept our messages. Hitherto it has not been possible to receive messages on aeroplanes, on account of the noise of the engines, but this difficulty has now been overcome. Mr. Marconi considered that the Allies were ahead of the enemy in science as applied to wireless work, but not in organisation. He stated also that wireless telephony from aircraft was already feasible, and that not too much importance should be attached to the German attempts to jam the wireless between our warships at sea.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—May 24th. N.S.W. Government Railways and Tramways. 16 600-volt D.C. motors for tramway stores, Randwick.*

June 20th. Sydney Municipal Council. Two-ton electric lorry. City Surveyor, Town Hall.

MELBOURNE.—May 31st. Victorian Government Railways. Transformers for five years. First order, 220 transformers in six months.*

June 14th. Victorian Railways. Electric lamps and lampholders for signal system.*

Belfast.—May 24th. Electricity Committee. Chain-grate mechanical stokers. See "Official Notices" to-day.

Canada.—May 15th. Ten knots of single-conductor submarine telegraph cable (107 lb. copper, and 150 lb. gutta-percha per knot) with iron wire sheathing, for Canadian Government Telegraph Service, Department of Public Works, Ottawa.*

Keighley.—May 22nd. Wiring of Fever Hospital and Sanatorium, Morton Banks. Specifications (10s.), Mr. H. Webber, Borough Electrical Engineer, Coney Lane.

Liverpool.—May 31st. Liverpool Overhead Railway. Twelve months' supply of electrical fittings. Particulars from General Manager, 31, James Street.

Manchester.—May 17th. Electricity Committee. Automatic coal-handling plant at Stuart Street station. See "Official Notices" May 5th.

Alternating-current or direct-current motors, 200 B.H.P. capacity, at Stuart Street station. Specifications (£1 1s.), Mr. F. E. Hughes, Secretary, Electricity Department.

New Zealand.—June 23rd. Oamaru Borough Council. Overhead mains and street-lighting equipment (Contract No. 2); power-station equipment (Pelton wheels, alternators, &c.) (Contract No. 3); service meters (Contract No. 4); line transformers and accessories (Contract No. 5).*

PAHIATUA.—July 10th. Borough Council. Overhead wires, poles, street lamps, gas engines, producers, dynamos, and auxiliary apparatus, accumulators. Specifications from Borough Offices or E. J. Fenn, Consulting Engineer, Auckland.*

Swindon.—May 30th. Corporation. Steam coal for the electricity works and waterworks respectively. See "Official Notices" to-day.

Wolverhampton.—May 19th. Corporation Electricity Department. Small coal. Mr. S. T. Allen, Chief Engineer and Manager, Commercial Road (returnable deposit of £1 1s.).

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Accrington.—Electricity Committee. Accepted tenders:

Water-cooling tower.—Lancashire Water Cooler Co.
2,000-KW. turbo-alternator, with condenser, &c.—B.T.H. Co., Ltd.
Boiler feed pumps.—J. P. Hall & Sons, Ltd.
Feed water heater.—Holden & Brooke, Ltd.
Modernising one set of mechanical stokers.—Bennis & Co., Ltd.

Canterbury.—T.C. Repairs to economiser: Green and Co., Ltd., £130.

Glasgow.—T.C. Tramways Committee. Recommended tenders:—

Points and crossings and special junction work.—Hadfields, Ltd.
Chilled-iron brake blocks (three months).—Miller & Co., Ltd.
Steel axles (six months).—Glasgow Railway Engineering Co., Ltd.
Steel tires (six months).—Brown Bayley's Steel Works, Ltd.
Fire-clay goods (12 months).—Glenboig Union Fire-clay Co., Ltd.; Douglas Fire-brick Co.; Speirs, Gibb & Co.

Keighley.—Corporation. Accepted tenders:—

Dorman, Long & Co.—Steel girders and steelwork for foundations for new 5,000-KW. turbo-alternator, £132.
H. V. Robinson, Ltd.—Foundations for 5,000-KW. turbo-alternator, £1,217.

Meter Contracts.—The following contracts have been placed with the Electrical Apparatus Co., Ltd.:—Burnham and District Electric Supply Co., electricity meters for one year; Malvern U.D.C., electricity meters for one year; Leyton U.D.C., electricity meters for one year.

Sunderland.—T.C. Tenders accepted on Wednesday:

J. W. & C. J. Phillips.—Four boiler-draught gauges.
E. Green & Son, Ltd.—C.I. damper.
General Electric Co., Ltd.—Six E.H.T. main boxes.

Wolverhampton.—Electricity Committee. Accepted tenders:—

J. E. Perry & Son.—To purchase and remove three Lancashire boilers, steel girder, and floorings, £655.
Strachan & Henshaw.—Installation of ash-handling plant, £515.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, May 12th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "The Latent Heats of Fusion of Metals and the Quantum Theory," by Mr. H. S. Allen; "Lenses for Light Distribution," by Mr. T. Smith; "The Choice of Glass for Cemented Objectives," by Mr. T. Smith.

Royal Institution of Great Britain.—Saturday, May 13th. At 3 p.m. At Albemarle Street, W. Lecture (II) on "X-rays and Crystals: First Results and their Applications," by Prof. W. H. Bragg, F.R.S.

Friday, May 19th. At 5.30 p.m. Lecture on "The Movements of the Earth's Pole," by Col. E. H. Hill, F.R.S.

University College, London.—Monday, May 15th. At 5.30 p.m. At Gower Street, W.C. Lecture on "The Manufacture of Nitrates from Air by Electric Power," by Mr. E. Kilburn Scott.

Tuesday, May 16th. At 5 p.m. Lecture on "The Rôle of Chemical Science in Civilisation," by Prof. F. G. Donnan, F.R.S.

Royal Society of Arts.—Monday, May 15th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor Lecture on "Vibrations, Waves and Resonance," by Mr. J. Erskine-Murray (Lecture III).

Institute of Engineers and Shipbuilders in Scotland.—Tuesday, May 16th. At 2.15 p.m. At the Royal Technical College, Glasgow. Address on "Engineering Industry in the Economic War," by Mr. T. C. Elder.

Chemical Society.—Thursday, May 18th. At 8.30 p.m. At Burlington House, Piccadilly, W. Lecture by Prof. F. Gowland Hopkins.

Institution of Mechanical Engineers.—Friday, May 19th. At 6 p.m. At Great George Street, S.W. Paper on "Spur-Gearing," by Mr. D. Adamson.

NOTES.

Electrical Methods in Surgical Advance.—At the Royal Institution on Friday last, Sir James Mackenzie Davidson delivered a lecture on "Electrical Methods in Surgical Advance." He said that the discovery of X-rays had revolutionised surgical diagnosis, but the shadow-picture produced by X-rays, however realistic it might appear, was not like an ordinary photograph from which the relative positions of objects could be inferred. To obviate this difficulty the stereoscopic method was largely used, but this, while invaluable in many respects, was not precise enough for exact localisation, and in order to arrive at the measurements required with mathematical accuracy, some system based on the principle of similar triangles was necessary. The lecturer gave a description of his own cross-thread localising method, and of a rapid procedure by which the measurements could be carried out with a small hand fluoroscope. Having ascertained the position of the foreign body, there were various electrical aids to the surgeon when he came to the question of its extraction. Of these, one of the most useful was the telephone attachment (already described in these columns); one terminal of the telephone being attached to the surgeon's instrument, and the other to a carbon plate placed on the patient's skin, a click was heard in the receiver when the electrical circuit was completed by contact with the foreign body. Another device was a telephone forceps with fluorescent screen attached, adapted by Dr. A. E. Barclay, of Manchester. Another instance of the adaptation of electrical methods to war surgery was Prof. Bergonié's electromagnet; this device, largely used in France, and of which the lecturer gave a demonstration, consisted of a large electromagnet excited with an alternating current. When the magnet was held over the suspected part, a vibratory motion was imparted to the projectile (if this were in the magnetic field), synchronising with the pulsing of the current. The surgeon felt the part, and became instantly aware of any vibration of the tissues, which indicated the presence of the metal. The point of maximum vibration having been selected, he made an incision at that point if convenient, and then the magnet was again used, and the incision deepened in accordance with the information it gave. It was stated that vibration was induced, not only in the ordinary magnetisable metals, but also in some of the non-magnetisable, including aluminium and copper.

A new Tungsten Arc Lamp.—At the meeting of the RÖNTGEN SOCIETY on May 2nd, Major Wilson, of the Canadian Medical Service, demonstrated a new enclosed tungsten arc lamp which he has devised for therapeutic purposes. He said that his idea originally was simply to produce a lamp capable of giving ultra-violet rays, but much more cheaply constructed than the ordinary large arc in use at some of the hospitals, and at the same time

more effective than the ordinary Finsen-Reyn lamp, and costing less for running than the Simpson arc. For this purpose he had devised a lamp, one of the electrodes being of pure tungsten, while the other was of carbon cored with tungsten, the tungsten powder being made into a paste and forced into the central cavity of the ordinary carbon. When the arc was formed, the tungsten was reduced in the intense heat, and rays of very short wave-length were liberated. The spectroscopic results showed that it was possible to get down to a wave-length of 2,000 Angström units. Cerium and other materials were tried, but nothing gave so good a result as tungsten, nor was any arrangement so effective as the tungsten and the carbon cored with tungsten powder. There was no sputter, and the arc worked quite automatically, a good quartz compressor being effective for bringing the rays on to the part in the therapeutic treatment of wounds. The president (Mr. J. H. Gardiner) suggested that uranium might be tried in the place of tungsten, the uranium spectrum being remarkable for its great masses of fine lines, and approaching a continuous spectrum. Radiations higher than a wave-length of 2,000 units could be obtained with metallic uranium. At the same meeting Mr. H. E. Donnithorne read a paper on a new modification of the ionisation method of measuring X-rays, and complained of the inadequacy of the ordinary milliamperemeter, which utterly failed to measure the exact value of the current passed through the tube.

Newspaper Science.—In these days, when all the non-technical Press has awakened to the fact that the demands of the technical Press for the cultivation of science, reiterated continually during the past 20 years, are fully justified, we may perhaps be merciful and regard its errors with a lenient eye. Yet we cannot altogether ignore a blunder which is not only ridiculous but also utterly gratuitous, especially when it is found in the columns of the leading daily journal, which has been a prominent advocate of reform in the nation's attitude towards science. Referring to Sir J. Mackenzie Davidson's lecture at the Royal Institution on "Electrical Methods in Surgical Science," the *Times* of May 6th, states that the lecturer dwelt upon the utility of the *spectroscope* in localising bullets in the body. How the reporter managed to substitute "spectroscope" for "stereoscope" we cannot tell, but it is clear that neither he, nor the sub-editors, had any notion of the respective uses of the two instruments, which are about as much alike as a compound microscope and a pair of spectacles, and are employed for purposes differing as widely. The operating surgeon has no use for the spectroscope, but has used the stereoscope with radiograms for years, and no one who knew the A B C of the subject could possibly have confused the two instruments.

Economy in Use of Coal.—The following letter has been sent by the Board of Trade to gas and electric lighting undertakings:—

"I am directed by the Board of Trade to state that, as you will be aware, difficulties have been experienced for some time in securing adequate supplies of coal for manufacturers of munitions, and other consumers of national importance, owing to the decline in the output of coal from the mines and the increase in the demand for war purposes. The position has been met in the past to a large extent by the restriction of export, but coal which is now being exported goes largely to meet the urgent requirements of our Allies, or is valuable as a weapon in negotiating with neutral countries.

"The Board have observed with some concern the recent decline in coal exports, and in their opinion it has become necessary that special steps should be taken to maintain, and if possible to increase, the exportable surplus of coal, and that for this purpose everything possible should be done to encourage economy in the use of fuel at the present time. A copy of the notice which they recently issued, recommending a reduction in the consumption of domestic coal, is enclosed for your information. The question has been further considered by the Central Coal and Coke Supplies Committee, and they have recommended that a general policy of economy in lighting should be adopted, and that gas and electric lighting undertakings should be asked to do what they can to reduce consumption by a definite amount. The Board think there can be little doubt that there are many cases in which light is at present being used needlessly or wasted altogether. They have accordingly decided to request owners of gas and electric lighting undertakings that they should notify their consumers that the Government desires to see the consumption of coal for lighting purposes reduced by 10 per cent., and they should do all in their power by notices and inspection to see this recommendation carried out. The Board would suggest that inspectors should be sent round as often as possible to examine meters, and hand to consumers, where necessary, a notice reminding them of the recommendation, and calling attention to the fact that they have not yet carried it out. The Board would be glad to be informed of the steps taken."

The Electrical Wholesalers' Federation, Ltd.—The annual general meeting of this Federation took place on Wednesday, April 26th. The chairman, Mr. R. W. Smith, in presenting the report of the Committee and reviewing the work of the year, said that many questions affecting the wholesale electrical trade had arisen, which the E.W.F. had been able to negotiate successfully. He appealed for more support from *bonâ fide* wholesale firms, so that the Federation should be thoroughly representative. Wholesale electrical firms desirous of becoming members can obtain all information from the Secretary, Electrical Wholesalers' Federation, Ltd., Amberley House, Norfolk Street, W.C.

Foreign Trade.—The April Figures.—The following are the electrical and machinery figures given in the official returns for April:—

	Month of April.	*Inc. or dec.*	*Inc. or dec. to date compared with 1915.*
Imports.			
Electrical goods and apparatus, excluding machinery and uninsulated wire... ...	£148,575	+ £58,432	+ £195,688
Machinery	637,917	− 239,889	− 13,998
Exports.			
Electrical goods and apparatus, excluding machinery and uninsulated wire	273,274	+ 34,375	+ 220,386
Machinery	1,284,348	− 290,107	− 400,967

X-Rays and Crystal Structure.—On the occasion of the sixth annual May lecture of the Institute of Metals, delivered on May 4th, Prof. W. H. Bragg, F.R.S., gave an interesting account of the new method of applying the properties of X-rays to the study of crystal structure, including the structure of certain metals. The method, it was shown by the Professor, results in the determination of the exact relative positions of the atoms of which the crystal is composed. It is not successful in every case as yet because of the lack of practice and experience of the experimenters in the new field, and because some of the interpretations are not fully understood.

Silver and copper have been shown to possess a very simple structure, in which the atoms are arranged as in the piling of shot. Bismuth and antimony have a distorted arrangement; but these two, as well as zinc, have not been completely determined. A beginning had been made with iron; the war has, however, stopped all work of the kind on this metal.

This new field of research, according to Prof. Bragg, depends on the well-known principle that when a regular train of waves falls upon a surface separating two media, part is reflected and part goes on. If the part that goes on meets another separating surface, a second portion is reflected, and some of this emerges from the second medium in the same direction as the beam reflected from the first surface. It will happen in general that the two reflected beams are out of phase, and to that extent destroy one another. Whether they do so or not depends upon the relation between the wave-length, the angle of the inclination of the beam to the reflecting surfaces, and the distance between the surfaces. In this way are explained the colours of the soap film, of the thin layer of oil on the surface of a liquid, of steel when being tempered, and so on. It is an essential cause of this effect that the wave-length and the spacing are not very different in amount. The X-rays consist of waves which are something like ten thousand times shorter than the wave-length of light. The layers of atoms in the crystal provide suitably spaced reflecting surfaces, and it is found that when a pencil of X-rays of a definite wave-length is allowed to fall upon the face of the crystal, and the crystal is gradually turned round so as to alter the angle of incidence, the reflection of the beam, as a whole, is non-existent except when the angle is right. Then it flashes out strongly. When this angle is observed, the relation of the wave-length to the spacing is known.

The instrument used is called the X-ray spectrometer. It has no lenses, because X-rays cannot be refracted; and the rays are invisible, so that, in place of the telescope, there is a chamber containing gas, which is ionised by the X-rays. The resulting electrical effect is observed in an electroscope. The measurement of the result is quantitative, so that in this respect the new spectrometer has an advantage over the old. In this way, if we use always the same X-ray, we can compare the spacings between the layers parallel to one after another of the natural faces of the crystal; and in this way we arrive finally at the crystal structure.

Engineers' Wages at Birmingham.—The Birmingham branch of the A.S.E. has made application to the Engineering Employers' Federation for an increase upon the day rate of wages. The men have pointed out that in many instances unskilled workers engaged under the piecework system are receiving higher wages than skilled engineers, and, further, that the increases which have already been granted are not commensurate with the increased cost of living and the additional responsibility placed upon them in consequence of the introduction into factories of workers with no previous experience. The *Birmingham Daily Post* states that some of the employers have met the demand of the men, but as others have not, the question is now the subject of negotiation between the Employers' Federation and the engineers' society. The matter has also been laid before the Minister of Munitions.

Faraday House Awards.—The following awards have been made as the outcome of the recent scholarship examinations at Faraday House Electrical Engineering College:—

A Faraday Scholarship of 50 guineas per annum, tenable for two years in college and one year in works, to F. I. Ray, of Bournemouth School.

A Maxwell Scholarship of 50 guineas per annum, tenable for one year in college and one year in works, to C. F. Fowler, of Brighton Grammar School.

An Entrance Exhibition of 20 guineas per annum, tenable for two years, to W. Parr-Dudley, of Cranbrook School.

Institution and Lecture Notes.—Belfast Association of Engineers.—The annual general meeting was held on April 27th, Mr. J. W. Kempster, D.L., presiding. In the course of his address the chairman said that in other centres the Engineering Associations were actively interesting themselves in the future, and the Manchester engineers had commenced an organisation by which they hoped to compete successfully with the foreigner when the war was over. Engineers needed to make up their minds whether collective effort on their part was desirable, and what it could effect; and if they thought it could do any good, they should throw in their lot with whatever organisation was formed to further the movement. They must not expect everything from the Government; the latter could only make use of the forces which were in existence.

Mr. Stanley Johnston moved:—"That this meeting of the Belfast Association of Engineers approves of the prompt organisation of the engineering industries within the British Empire, in co-operation with other industries, under State auspices, with the object of stimulating internal progress and of exerting collective influence and common action in the severely intense competition for trade in the markets of the world that, it is anticipated, will arise immediately upon the termination of the present war. That a copy of this resolution be sent to Mr. Edmund L. Hill, the honorary secretary of the Engineers' Club, Manchester, asking him to lay it before the Council for the Organisation of British Engineering Industries, assuring him of the co-operation of our Belfast Association of Engineers in the effort to organise the British engineering industry, and expressing the hope that the organisation may extend to all industries throughout the Empire, including those of Ireland." He said when the war broke out British engineering firms were unprepared; they were isolated from each other, and their own petty jealousies were keeping them apart. It was not until the Ministry of Munitions was established that there was any co-operation, and now they were all working as one great organisation, under one head. This moulding together of our great engineering industries had been one of the wonders of the Allies. Three thousand firms had been taken over and controlled by one department, and 13,000 firms, with almost 2,000,000 employés, were working on munitions. The great question to be faced now—not when the war was over—was: what had to be done to turn those 2,000,000 workers back to the ordinary commercial life that existed before the war? They were told that Germany was ready to dump on the United Kingdom, after the war, a greater quantity of goods than ever before. Were they going to sit down and wait for that event? This was the problem which had to be faced, and the sooner we had a Ministry of Commerce the better. The motion was unanimously passed.

Institution of Electrical Engineers.—A special general meeting of the Corporate Members will be held on May 25th, at 5 p.m., for the purpose of considering the following resolution:—"That the following words be added to Article 41 of the Articles of Association, namely:—

'(*a*) On and after the 15th day of June, 1916, no person, whether a naturalised British subject or not, who is or shall be or has or shall have ever been a subject of a country or State, then or thereafter at war with His Majesty or his successors, shall be or continue to be or be eligible for election as a member of any class of the Institution, provided nevertheless that the above disability shall not apply to a person who having at any time been a subject of such a country or State as aforesaid shall have become and shall be a naturalised British subject and shall prove to the satisfaction of the Council that under the laws of such country or State he has ceased to be and is not a subject thereof.'"

Should the above resolution be passed by the requisite majority, a further special general meeting of the Corporate Members of the Institution will be held on June 15th, at 5.15 p.m., when the resolution will be submitted for confirmation as a special resolution.

At the meeting of the YORKSHIRE LOCAL SECTION, on Wednesday last, a paper was read by Mr. G. Dearle on "The Economical Production of Power from Coke-oven Gas."

Electrical Association of Australia (Victorian Section).—At a meeting held on March 30th, Mr. F. A. McCarty delivered his presidential address.

Association of Supervising Electricians.—The meeting announced for May 16th will not take place, owing to Mr. F. C. Raphael having accepted a commission in the Royal Engineers. Other arrangements are being made, of which notice will be given.

The Textile Institute and Research.—The outstanding feature of the annual meeting of the Textile Institute, which was held in Manchester on Friday last, was the evidence of increasing recognition of the importance of research work. The annual report stated that in addition to a special investigation which was to be carried out at the Bradford Technical College, a special research in relation to the control of the electrification of textile fibres during processes of manufacture had been initiated. Dr. William Garnett (late educational adviser to the London County Council), in a paper on "Industry, Education, and Research," spoke of the need for breaking down the academic isolation of the schools and bringing them more closely into touch with the everyday life and experience of the children—a reform which must commence in the training colleges. His principal word to the manufacturers of the country was the need of confidence and combination for successful competition with Germany and America after the war. Individualism might serve very well in competition for home trade, where all were on an equal footing, but it could not compete with organised collectivism in foreign markets. If in one country all the manufacturers in a particular trade combined to carry out scientific research, and so to distribute manufactures that there was the minimum duplication of plant, and each works produced those goods which it could manufacture with the greatest economy, they need not add the assistance of the Diplomatic Corps to see sufficient reasons why the individual firms of another country should find it hard to compete. Dr. Garnett spoke hopefully of the possible work of the Advisory Council for Research, and stated that the Council had made a start on sound lines. After outlining the way in which the Textile Institute might further industrial research in the textile trades, he concluded with one "small piece of advice"—never to regard with complacency the loss of any branch of trade, however small or unremunerative. It was very easy to be too late in defensive action.

Mr. H. Lesser, President of the National Federation of Employés' Approved Societies, read a paper on "Employers and National Health Insurance," in which he described the formation and work and advantages of approved societies for the employés of one or more employers. Mr. Joseph Taylor, secretary of the British Thomson-Houston Employés' Friendly Society, Rugby, opened the discussion. He alluded to the closer relationships between employers and employed that were often made possible through the employés' friendly society, and remarked upon the willingness of the employers to give help in any way which was calculated to be mutually advantageous. His own society had well-equipped ambulance stations throughout the works, not only for dealing with accidents but for attending to, say, a man with a headache, who could be given a draught by qualified persons which would probably put him right and enable him to resume his work and prevent him losing time, while giving the employers the advantage of having his machine running, and not idle. Mr. Taylor strongly recommended textile manufacturers who had not their own friendly societies to start them without delay. Other speakers spoke appreciatively of the benefits of these societies, not only to the employés but to the employers as well.

Sir William Mather (President of the Institute), who has been indisposed recently, was not present at the meeting. He was re-elected President for a second year.

The Metric System.—*Apropos* of the recent references in our columns to the metric system, the following extract from the paper on "Education, Industry and Research," read by Dr. William Garnett before the Textile Institute in Manchester, last Friday, is interesting:—"There is one subject of instruction in the schools in respect of which the trade of the country is in a better position to form a judgment than any education authorities or bodies of teachers; I refer to the metric system. I am quite prepared to set aside for the present the question of decimal coinage, but all our children should be taught to think in terms of the metric system of weights and measures. I have recently been examining statistics respecting the food supply of this country and of Germany. I find that sometimes two Government departments adopt different units for their statistical returns. I find ounces, pounds, hundredweights, tons, quarts, gallons all used more or less indiscriminately in the books I have consulted, and then, as soon as physiological science is brought to bear on the statistics, grammes and litres, kilogrammes and metric tons, with the great and small calorie and the kilo-litre calorie for heat values, are introduced along with the ounces and pounds of the British statistics. But these difficulties are trivial as compared with the effects of an insular system of weights and measures on foreign countries which have adopted the metric system. . . . The metric system is slowly, but very slowly, gaining ground in this country. Metric screw threads have found their way into British tool making, and only a few days ago I was interested in finding a small boy in a veneer shop in Shoreditch quoting three-ply birch in millimetres of thickness. The average Briton, however, still refuses to read any article which is written in terms of the metric system, regarding it as outside his comprehension. . . . . For the purpose of foreign trade we are bound to learn a system which is almost universal among other civilised countries."

South African Electrical Trade.—The annual report of the Johannesburg Chamber of Commerce, in reviewing the trade of 1915, states that the electrical trade has suffered throughout the year, owing to shortage of stocks consequent upon the abnormal conditions prevailing in British manufacturing circles, and also the restriction of shipping facilities. The demand from the mines for electrical machinery and supplies has been substantially maintained, but there has been a reduced inquiry from the Government Department and electrical wiring contractors. Cost prices have increased considerably, and this fact, in conjunction with the increased rates of freight and insurance and shortage of stocks, has caused a substantial rise in selling prices. While the British firms have derived some benefit from the elimination of cheap German goods, there has been a considerable amount of competition from neutral countries. It seems evident that when the war is over and German goods are again available, British electrical industries will continue to be seriously affected, unless some preventive steps are taken. The prospects for the current year (1916) are not too encouraging.—*South African Mining Journal.*

Fatality.—BRADFORD.—An inquest was opened on Friday last week, and adjourned to Wednesday, in regard to the death of Alfred Dickenson (31), married, a switchboard man in the employ of the Corporation electricity department. It seemed that he was engaged in his employment at Thornbury sub-station, when he touched a live wire and died as a result of the shock.

Electric Vehicle Committee.—The Society of Motor Manufacturers and Traders, Ltd., has appointed Mr. T. C. Pullinger, of Arrol-Johnston, Ltd., to represent this society upon the Electric Vehicle Committee.

Inquiries.—Makers of ferro-type sheet for telephone diaphragms are asked for.

Appointments Vacant.—Engineer-in-charge (40s. to 45s.), for the Borough of Bedford electricity department.

Volunteer Notes.—ENGINEERING INSTITUTIONS' V.E.C.—At the desire of General Sir O'Moore Creagh, the Corps has joined with the 4th Battalion Central London Regiment (Architects' Corps), under the command of Lieut-Col. C. B. Clay, V.D., to form the 1st London Engineer Volunteer Corps. The identity of the Corps will be preserved in the Engineering Institutions' Company, and the funds will also remain separate.

1ST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Friday, May 12th.—Technical, at 46, Regency Street, S.W. for Sections 3 and 4, No. 3 Company; Squad and Platoon Drill for Sections 1 and 2, No. 3 Company, at Chester House; Signalling Class and Recruits, No. 3 Company, at Chester House.

Saturday, May 13th.—Company Commander E. G. Fleming's Instruction Class, at Chester House, at 2.30.

Musketry.—See notice, Tables A and B, at Headquarters.

Sunday, May 14th.—Major-General Sir Francis Lloyd, K.C.B. (G.O.C. London District), will make an inspection of the Corps at work on the Sections of the South London Defences allotted to them. Every member should make special efforts to attend. Parade, Victoria Station (S.E. & C. Railway Booking Office), at 9 a.m., for special train. Uniform, haversacks and water-bottles. Mid-day rations to be carried. Railway vouchers will be provided.

Notice.—The Parade for Richmond Park, on Sunday, May 21st, is cancelled.

MACLEOD YEARSLEY, *Adjutant.*

May 8th, 1916.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, May 11th, 1916:—

Week-End Parades.—Saturday.—The Battalion will Parade at Baker Street Station, at 2.30 p.m., and proceed by train to Wembley Park for Battalion Drill.

Sunday.—The Battalion will Parade at 9.30 a.m., at Liverpool Street Station (Low Level entrance, G.E.R.), and proceed by train for Entrenching duties. Members will carry their own lunch, and the Quartermaster will make arrangements for light liquid refreshments. The Battalion will return to town about 6 p.m.

Musketry.—Inter-Battalion Cup Competition. Bisley Range will be open for shooting all day on Saturday next, the 13th inst., to those members whose names appeared in Monday's Orders.

Morning Train.—Members to report, in uniform, to Sergeant Burmester, at 9.20 a.m., Platform No. 6, Waterloo Station.

Afternoon Train.—Members to report to Platoon Commander M. H. Galsworthy, at 12.45 p.m., same platform.

A. G. JOINER, *Major and Adjutant*, O.B.C.

South African Agencies Wanted.—H.M. Trade Commissioner in South Africa (Mr. W. G. Wickham) reports that a firm in Johannesburg wishes to obtain agencies covering the Transvaal, Natal and Rhodesia, of United Kingdom manufacturers of H.T. oil-break switches and switchgear, motors, transformers, electricity meters of all descriptions, and electric mine-signalling apparatus (such as bells, pulls and pushes). The name and address of the firm can be ascertained on application to the Commercial Intelligence Branch of the Board of Trade in London. Reference number 161.

Electrical Operation of Panama Canal Locks.—At a meeting of the Western Society of Electrical Engineers, held in Chicago, it was stated in a paper entitled "The First Year's Operation of the Panama Canal Locks" by Messrs. F. C. Clark and R. H. Whitehead, respectively superintendent and assistant superintendant of lock operation, that in the first year 1,370 vessels were locked through the canal without any accident whatever. The control apparatus had given excellent results, and it was only by the use of such a control system that so large a system of locks could be operated properly. Both up and down lockages were made at about twice the speed that was anticipated. Both lock operators and canal pilots were given very careful training. The night illumination of the locks had proved entirely satisfactory, so that vessels could pass through the locks as freely at night as by day. Electric locomotives used in towing and guiding vessels through the locks were designed for a speed of two miles per hour; it was feared that this speed would be too high when it came to handling very large vessels, so a scheme by which the locomotive speed could be reduced to one mile an hour was developed through concatenation of the motors. It had been found, however, that practically all vessels could be manipulated at the speed of two miles an hour without danger or trouble. Bids were being sought on a number of additional towing locomotives, in which certain improvements were to be incorporated.—*Electrical Review and Western Electrician.*

Bequest.—*The Times* states that the late Mr. Thomas Taylor, of Blackpool, left £1,000 to the Corporation of Ashton, for scholarships in electrical science at the Reginbottom Technical Schools.

Substitute for Platinum Leading-in Wires. — A note in *La Revue Electrique* describes a substitute for platinum for the leading-in wires of glow lamps, invented by Mr. Byron E. Eldred. Two conditions must be satisfied to make a permanently sound joint between the wire and the glass: the metal must be "moistened" by the glass, to secure adhesion, and the glass and metal must have practically the same coefficient of expansion. Platinum fulfils both these conditions, but expands slightly more than glass, so that when the joint is cold, the wire contracts more than the glass, and thus the glass sheath, sticking to the wire, is in a state of tension. Obviously it would be preferable to use an alloy having a coefficient of expansion slightly less than that of glass, so that on cooling the glass would be compressed. This condition is fulfilled by certain nickel-iron alloys, which, however, do not possess to so high a degree as platinum the property of adhering to glass. To remove this objection, Mr. Eldred uses a nickel-steel wire coated with a layer of copper and a final layer of platinum, the thicknesses being so chosen that the joint coefficient of expansion is a little less than that of glass, while the coating of platinum ensures good adhesion. The layer of copper improves the conductivity of the wire—a matter of some importance when dealing with very fine wires—and regularises the expansion of the nickel-steel, which presents some perceptible irregularities between the temperature limits that the wire must endure.

Metallurgical Research. — On Monday last the Standing Committee on Metallurgy, appointed by the Advisory Council for Scientific and Industrial Research, held its first meeting, under the chairmanship of Sir Gerard Muntz, who is also chairman of the Section on the Metallurgy of Non-ferrous Metals, Sir Robt. Hadfield being chairman of the Section on the Metallurgy of Ferrous Metals. In the course of an opening statement to his Section, Sir Robt. Hadfield referred to the necessity of improvements in electrical pyrometers, electric furnace practice, and the electrical and magnetic properties of various alloys.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Reading Tramways Committee has recommended that the salary of the general manager and engineer be increased from £550 to £600 a year from April 1st, instead of January 1st next.

Aberdare U.D.C. has increased the salary of Mr. A. J. ABRAHAM, general manager of the electricity and tramways departments, by £50 per annum.

A Sydney newspaper states that the proposal of the Electric Lighting Committee to appoint Mr. P. T. DAVIES, of Montreal, to the position of deputy general manager of the electric light department, caused a long discussion in the City Council. As against the appointment of Mr. Davies, the claims of Mr. S. T. MALING, a Victorian, were urged by Ald. Farrell, who vigorously pleaded for the appointment of an Australian. Eventually an amendment approving of the appointment of Mr. Maling was carried.

The Wolverhampton Corporation is recommended to increase the salary of Mr. J. S. DUDLEY, maintenance engineer, from £160 to £170 a year, and that of Mr. J. WYATT, second clerk in the electricity department, from £114 to £125 per annum.

General.—SIR HIRAM MAXIM has accepted the invitation of the Aeronautical Institute of Great Britain to become its first president.

The Tonbridge U.D.C. has decided to grant £12 10s. per annum to the electrical engineer, Mr. M. P. PLUNKETT, for taking over the responsibility of the electrical plant at the sewage works.

The marriage took place at Southampton, on April 26th, of Mr. WM. BOWEN, A.M.I.E.E., of Leeds, to Miss Elsie Marion Winship.

Mr. G. G. HAZARD, London representative of Siemens Brothers Dynamo Works, Ltd., of Upper Thames Street, E.C., has been appointed to the A.S.C., M.T., as from May 8th.

Mr. R. C. HATTON, Southern sectional engineer of the Yorkshire Electric Power Co. (previously on the staff of the mains department of the County of London Electric Supply Co., Ltd.) was married on April 22nd.

Sir C. A. PARSONS, K.C.B., and Mr. CHAS. BRIGHT, F.R.S.E., are two of the members of the new committee which has been appointed to inquire into the administration and command of the Air Service.

London Gazette notice: Territorial Force. London Electrical Engineers. Second-Lieutenant (temporary Captain) A. R. Z. PORTER, from London Regiment, to be Lieutenant (temp.).

Roll of Honour.—Amongst the prisoners taken by the Turks at Kut-el-Amara on the surrender of the garrison is Mr. A. J. WALDRON, who was, before the war, on the staff of the Western Union Telegraph Co., at Penzance.

Flight Sub-Lieutenant WARNER H. POBERDY, formerly a student engineer with the British Thomson-Houston Co., Ltd., of Rugby, and who was later in Canada, has been invalided home to Rugby as the result of a serious aeroplane accident in Flanders.

Private CHAS. HAROLD DAVID, of the Canadian Regiment, who was on the staff of the Bell Telephone Co., of Toronto, until he joined the Expeditionary Force, has fallen in action in France.

Private Alfred Whitehead, of the Royal Fusiliers, who, prior to his enlistment, was engaged at the British Westinghouse Works, Trafford Park, has been wounded, and his right leg has had to be amputated.

Lieutenant Mulliner, assistant borough electrical engineer at Eccles, is on sick furlough. He has been suffering from nervous breakdown, after service at the Front. He has now left the Hospital for Officers at Hampstead, and gone to his home at Malvern.

Mr. Wm. Hamblin, formerly a fireman at the Barnsley power house of the Yorkshire Electric Power Co., who was in the K.O.Y.L.I., was killed in France in January.

Second-Lieutenant J. Fisher, of the North Staffordshire Regiment, to which he was commissioned from the Honourable Artillery Company, has died from the effects of gas received at the Front. He was formerly engaged at Siemens Brothers Dynamo Works, Stafford, and was 25 years of age.

Obituary.—Lieut.-Col. St. George R. S. Caulfield.—The *Morning Post* states that Lieut.-Col. St. George R. S. Caulfield, of the Royal Engineers, while playing golf at Leeds, died from heart failure. He was for a time Chief Instructor at the School of Submarine Mining and Electric Lighting.

Will.—According to the *Times*, the late Mr. Harold Faraday, Hampstead, and Wardour Street, W., electrical engineer and manufacturer, left £29,495.

NEW COMPANIES REGISTERED.

K. E. Syndicate, Ltd. (143,777).—Registered May 5th by Kenneth Brown, Baker, Baker & Co., Lennox House, Norfolk Street, W.C. Capital £1,000 in £1 shares. Objects: To acquire certain options and rights in respect of two inventions, relating respectively to electric arc lamps and to improvements in direction indicators, to carry on the business of electricians, manufacturers of and dealers in electrical, geometrical, chemical, photographic, and scientific apparatus and materials, &c., and to adopt an agreement with G. A. Knapton and H. Justus Eck. The subscribers (with one share each) are: H. C. Leggatt, 36, St. Mary's Square, Kennington, S.E., solicitor's clerk; H. T. Page, 60, Ballance Road, Homerton, N.E., solicitor's clerk. Private company. The first directors (to number not less than two or more than four) are G. A. Knapton, H. Justus Eck, F. Rutherfoord Harris (chairman), and R. O. Graham, each of whom may retain office for five years. Solicitors: Kenneth Brown, Baker, Baker & Co.

Haddow & Co., Ltd. (9,579).—This company was registered in Edinburgh on April 28th, with a capital of £3,000 in £1 shares (500 pref.), to take over the business of electrical contractors carried on by Haddow and Co., at 107, Douglas Street and 192, West George Lane; and by A. Wylie & Co., 10, Wemyss Place, all in Glasgow. The subscribers (with one share each) are: A. F. Wylie, Calderwood Road, Glasgow; J. S. Hutchison, 107, Douglas Street, Glasgow. Private company. The number of directors is not to be less than two or more than five; the first are A. F. Wylie and J. S. Hutchison. Registered by J. Oswald & Son, Edinburgh.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sun Electrical Co., Ltd.—A memorandum of satisfaction to the extent of £275 on April 28th, 1916, of debenture stock dated March 31st, 1912, securing £7,000, has been filed.

Productive Engineers, Ltd.—Issue on April 27th, 1916, of £600 debs., part of a series of which particulars have already been filed.

Burgess Hill & District Electric Supply Co., Ltd. (85,698).—Capital, £6,000 in £1 shares (3,000 pref.). Return dated March 10th, 1916. All shares taken up; £5,900 paid; £100 considered as paid. Mortgages and charges: £1,200.

Record Electrical Co., Ltd.—Particulars of £7,000 debs., created April 6th, 1916, filed pursuant to Section 93 (3), Companies (Consolidation) Act, 1908, the amount of the present issue being £6,000. Property charged: The company's undertaking and property, present and future. No trustees.

G. H. Turner & Co., Ltd.—Issue on April 14th, 1916, of £200 second debs., part of a series of which particulars have already been filed.

CITY NOTES.

West India and Panama Telegraph Co., Ltd.

For the last half of 1915 the amount to credit of revenue is £33,553, as compared with £49,935 in the corresponding half-year of 1914, and the expenses have been £22,987, against £31,251. Including the balance brought forward and interest on investments, there is available £14,649. The directors propose dividends for half-year to December, 1915, on the first preference shares at 6s. per share, and on the second preference shares at 6s. per share, carrying forward £2,880. The board have thought it well to recommend that the above balance be carried forward. The traffic receipts for the half-year show a falling-off of £16,529 as compared with those of the corresponding period of 1914, when an abnormal volume of traffic was carried. Beyond the reduced traffics the company also suffered from the hurricane referred to below. At the date of the last report it was not possible to gauge the effect of the severe hurricane that in August passed over the West Indies, extending from Cuba and Jamaica to Guadeloupe, to which disturbance the simultaneous interruption of their two main cables between Porto Rico and Jamaica is attributable. This interruption lasted for twelve days, and necessitated the use, at considerable cost, of alternative connecting lines for carrying the traffic during the emergency. It is many years since a similar disaster happened to these two cables. Consequent upon, and as a direct result of, war conditions, the working expenses, although on the whole less than those for the corresponding period, are above the average of the previous few years, and no immediate reduction can be hoped for. The value of cable used in repairs and renewals was particularly heavy during the half-year; and, in the opinion of the board, the amount properly chargeable on this account against reserve for depreciation is £5,451.—*Financier.*

Shanghai Electric Construction Co., Ltd.

For 1915 the profit is £31,084 (compared with £33,602 for 1914), plus £4,703 brought forward, making £35,787. There has been transferred to reserve for renewals account £10,000, and applied in reduction of the preliminary expenses account £2,000; a dividend of 7 per cent. for the year, less income-tax, requires £22,400, leaving £1,387 to be carried forward. The loss by exchange on subsidiary coinage in 1915 was £31,707, which was equal to 9.91 per cent. on the capital. Profits had been converted into sterling at an average rate of 1s. 9d. to the Mexican dollar, as against 1s. 9½d. for the preceding year. Since the close of the year the improvement in the rate of sterling exchange had been material, and there was a tendency towards improvement in regard to depreciation of subsidiary coinage, which was likely to be maintained while the price of copper retained its present high level. The effects of the war on general conditions in Shanghai, and on the company's traffic, were seriously felt during the first half of the year; gradual recovery had since taken place, and the traffics and net receipts for the current year were the best in the history of the company. Ten motor cars had been added to the rolling stock, making 90, and an application had been made to the Municipal Council for leave to introduce a further 15 trailers, making 70 in all. They also had seven railless cars. After the relaying of Fokien Road in cement concrete, the service of railless electric cars was resumed on July 6th, 1915, and had operated successfully ever since. These cars were extremely popular. Application had been made for sanction to a small extension of this route, for which the cars in stock were sufficient. Passengers carried 59,749,710, an increase of 4,102,472; passengers per car mile 17.86, as against 16.97 in 1914; gross receipts per car mile 8.46d., an increase of .08d.; average effective receipts per passenger .35d., as against .37d. in 1914. Annual meeting: May 19th.

British Ever-Ready Co., Ltd.

For the year ended March 31st, 1916, the profit, including the amount brought forward and after writing off depreciation and transferring £7,500 to general reserve, was £59,218. The preference dividend of 10 per cent. absorbs £8,500, 10 per cent. dividend for the year on the ordinary requires £11,500, and a bonus of 10 per cent. for the year (making a total of 20 per cent.) requires a further £11,500, leaving £27,718 to be carried forward. It is anticipated that the excess profits tax for 1914-15 and 1915-16 will absorb the greater part of this carry-forward. The increasing business of the company has necessitated acquiring additional factory accommodation. New premises will shortly be taken over at Clissold Park of approximately 20,000 superficial feet area, and it is hoped that this factory will be in full working order by the end of May, 1916. The business is a controlled establishment under the Ministry of Munitions. Annual meeting: June 1st.

Lisbon Electric Tramways, Ltd.

The result of operations during 1915, after deducting interest and amortisation due on the debentures of the Companhia Carris de Ferro de Lisboa, and after the payment of £25,570 for interest on and redemption of the debentures of this company, and also the payment of London office expenses and directors' remuneration, shows a net profit of £59,917, plus £2,883 brought forward. The usual 6 per cent. preference dividend has been paid, absorbing £25,533, and after paying 4½ per cent. net for the year on the ordinary shares, £8,736 is to be carried forward. In order to meet this year's contribution to depreciation reserve, £25,000 has been transferred to that account from the exchange reserve to represent this year's appropriation, it being considered that this sum would have been available out of profits for this purpose, had it not been for the heavy fall in the rate of exchange, and as the exchange reserve account was set aside for this purpose it now falls to be drawn upon. The tramways carried 67,101,249 passengers, earning Es.2,022,143 $93,5, as compared with 63,758,037 passengers, earning Es.1,938,210-$79,3 in 1914, but though the receipts and passengers continued to expand, there was a considerable addition to the expenditure consequent upon the abnormal high price of coal and other supplies, and of labour. The company also suffered from the heavy depreciation in the exchange, the average rate of which during the year has fallen from 43.43d. to 35.97d. The system was closed down for two days during May, 1915, owing to political disturbances; this was the only interruption. With the exception of one small incline, which it is hoped will be completed during 1916, the remainder of the Ascensores line have been electrified and re-opened to traffic during the past year. The directors express their appreciation of the services of the local board in Lisbon, of Mr. A. O. Kolkhorst, the general manager, and of the entire staff. Annual meeting: May 17th.

Calcutta Tramways Co., Ltd.

Sir Henry Kimber presided at the annual meeting on May 4th. He said that the traffic receipts showed a falling off of only £1,313, and the working expenses were less by £2,683 than in 1914. During the first half of the year there was a drop of over £5,000 in traffic, as compared to pre-war takings, but in the second half there was an increase of upwards of £4,000. The principal portion of the new capital expenditure of £11,720 was due to the outlay on the completion of the new Dalhousie Square sub-station, and the major portion of the cost of the new A.C. set at the Nonapookur power station and the works in connection with its erection. With regard to the prospects for the current year, whilst the aggregate receipts up to now showed an increase of £4,721 over those for the same period last year, they must expect that, with the continuance of the war, the cost of all materials, freights, &c., would continue to advance, with the addition of increased import duties and income-tax to be levied in India. There had been a discussion going on in a great number of companies having their headquarters in England, and their works and businesses overseas, with a view to escaping double income-tax. The speaker referred to, and quoted from, a paper on the subject issued by the London Chamber of Commerce, giving the reasoning for and against double income-tax. The company now had a system of about 35 miles; their traffic receipts were 10.16d. per car mile, and the expenses 5.21d.

Indian Electric Supply and Traction Co., Ltd.

Mr. J. G. B. Stone, presiding at the annual meeting on May 5th, said that the increase in the number of units sold was 598,928, or 25 per cent. and the net profit in Cawnpore increased by about 25 per cent. The actual price per unit was slightly lower, but this had been more than balanced by the lower cost of generation. The supply side of the business continued to expand, and there were new districts awaiting development as soon as general conditions allowed. They must for the time being refrain from undertaking new work, for even supposing they were able to raise the capital, there would be a difficulty in getting the Treasury to sanction its issue. They must also consider the enormous increase in the cost of copper, machinery, plant, and material, and the prohibitive rates for freight. In regard to the last of these, the increase was from 50 per cent. to 75 per cent. over pre-war rates, and, in addition, there were increased amounts to pay for insurance. The short length of tramway still yielded no profit, although it was a convenience to the Indian population. It was too short to become a paying concern on the very low fares it was necessary to charge to attract passengers, there being no European traffic, and at present there was no encouragement to extend the system. They had placed to general reserve £2,000, and to depreciation and renewals account £3,000; they had also written £500 off the expenses of the debenture issue. The position for the current year was satisfactory, as the profits showed an increase.

Canadian Westinghouse Co.—The annual report shows net earnings for the year 1915 amounting to $860,628; property and plant account takes $150,000, and $261,285 is carried forward. The total surplus of the company is now $1,823,775, and the total assets $8,330,757. Regarding business conditions, the annual report says:—"The industrial life of Canada during the year just closed experienced a remarkable recovery from the suspended activity of the preceding year. Many plants which had with difficulty kept together an irreducible minimum of their operating organisation found themselves early in 1915 strained to their utmost capacity under night and day operation. In addition, numerous new industries have been brought into being, the changed conditions in these respects being the direct result of large purchases in Canada by the British and Allied Governments of various supplies and munitions of war."

Anglo-Portuguese Telephone Co., Ltd.—The profit and loss account shows a gross revenue of £81,923, of which operating, management and general expenses absorbed £51,577, and royalties to the Portuguese Government £2,459, leaving a gross profit of £27,886. After payment of income-tax £1,349, and providing for debenture interest £1,937, and sinking fund £1,662, the amount available for disposal, including £5,471 brought forward, is £28,409. Of this amount £2,000 has been added to exchange fluctuation account, and £10,000 to the renewals fund. An interim dividend of 3 per cent. was paid, less income-tax, last November. The directors now recommend a further dividend of 5 per cent., less tax, making a total distribution of 8 per cent. for the year, leaving £4,409 to be carried forward.

Eastern Telegraph Co., Ltd.—A final dividend of £2 5s. per cent. is recommended on the ordinary stock, also a bonus of £2 per cent., both free of income-tax, making a total of 8 per cent. for the year 1915.

Bell's United Asbestos Co., Ltd.—For 1915 the total distribution on the ordinary shares has been 15 per cent., placing £15,000 to reserve, and carrying £7,942 forward.

Auckland Electric Tramways Co., Ltd.—An interim dividend of 7d. per share, less tax, on the ordinary shares is announced.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets are somewhat under the influence of the new Military Service Bill. Members of the House, their staffs, and their clients are all affected, in a greater or less degree. There is, of course, no shirking of the responsibilities or of the sacrifices which are called for. But if all men up to the age of 41 are called up within any brief space of time, business must suffer from disorganisation; and it will be some little while before the machine of commerce gets into smooth running order again. The Daylight Saving Bill is vigorously discussed in the Stock Exchange, but has had no effect in the market for electric lighting shares. The encouraging Board of Trade figures for April are helping Home Railway stocks. In the telegraph section, there is more inquiry than hitherto for the issues of the Anglo-American companies. The Globe Telegraph & Trust has increased its dividend by 1 per cent.

The Electric Lighting market's prices are unchanged, despite the proposed introduction of the Daylight Saving Bill. The market views the measure with equanimity, and the proprietor of electric lighting shares need not be troubled by the recent newspaper outpourings with reference to the effect it is likely to have upon the companies.

The summer-time is obviously the lean one for Electric Supply concerns. In some cases, the undertakers reduce the price of their current, by way of inducement to users, and it is well-known that in pre-war days they earned comparatively little in the summer months. The Government's appeal to the public that they should economise in the matter of coal, gas, and electric light, may affect the first two items, but so far as the last is concerned the public have probably got down to something like bed-rock in their bills for light and power.

As it is not proposed that the Daylight Saving Bill should be in operation throughout the winter, when the demand for current is greatest, it is contended in the Stock Exchange that the Bill will have little effect upon the receipts of the companies. A few investors in these shares show signs of nervousness, due, probably, to a lack of appreciation of the actual position—moved thereto by the newspaper comments aforementioned. The great body of proprietors, however, is not at all likely to be disturbed by the latest developments; and a guess may be hazarded that neither the Daylight Saving Bill nor the Government appeal will affect the dividends of the industry to the extent of one per cent.

Underground Electric income bonds have started to recover, but Districts continue dull, and have slipped back to 18¾ on the offering of a little stock for deceased accounts. Central London assented ordinary keeps very steady. There is, however, a few hundred pounds of the Company's deferred ordinary offered at 65½ or thereabouts, the return on which works out to 6 per cent. on the money, though the dividend on this, unlike the interest payments on Underground Electric income bonds, is paid less income-tax. The unassented deferred stock of the Central London Railway is changing hands at 25, some 40 points below that of the assented issue.

Anglo-American Telegraph preferred has risen to within a fraction of par, and the deferred stock braced up to 21¼. The Eastern group is steady, with a further rise in Globe Telegraph ordinary shares to 12, on the increase of 1 per cent. in the dividend to 7 per cent. Great Northerns are £1 up, but Indo-Europeans at 49 have lost an equal amount, though it may be doubted whether a buyer, even at 50, would find many Indo-Europeans available at that price. West India and Panama shares eased off to 1 1/16. Marconis are a slightly better market, the parent shares hardening to 2 3/16; but the subsidiaries are dullish at 14s. 9d. for Americans and 7s. 9d. for Canadian Marconi.

The telegraph manufacturing shares are strong. India-Rubbers at 10¼ have gained the fraction. Telegraph Constructions went up £1 to 36½; while as regards Henleys and Callenders, there are very few shares about. British Insulated at 10⅛ are a good market.

Edison & Swan fully-paid shares, after their remarkable jump of 12s. 6d. last week, have receded ⅛ to 1¼, shares naturally being tempted out by the big advance. At the same time, the partly-paid eased off to 11s. 6d., this still leaving them 2s. 6d. higher than they were a fortnight ago. British Westinghouse preference continue to mend, and Electric Constructions at 16s. 6d. are better.

The rises in the chemical group have suffered something of a check, although the market in them generally is a firm one. Here, however, as in the rest of the Stock Exchange, business is handicapped for the time being by the various uncertainties that arise out of the Military Service Act, which have had the effect of removing buying orders. Babcock & Wilcox keep steady, the little disappointment in connection with the dividend being counterbalanced by the excellence of the report. Rubber shares are heavy and dull. All the sparkle has evaporated from the market for the moment. Unexpected

restrictions laid upon the export of rubber to Russia, and the falling away in the demand from the United States, are put forward as being the two principal reasons for the way in which the wind has gone out of the sails of the market, leaving them flapping heavily and idly. The provinces have ceased their voracious rush for shares; and the disposition now is to wait and see what is going to happen next.

Brazilian Tractions lost the rise that they gained last week, New York coming in with shares to sell. Mexican utilities are generally better. The first mortgage bonds of both the Tramways and the Light & Power Companies have strengthened to 41, stock being wanted at that figure in each case. The rise in the price of silver has been well held; and notwithstanding the absence of definitely good news from Mexico, indirect evidences add point to the hope that the country may be settling down, after all.

Argentine Tramway shares, first and second preference, have drooped ¼, there being some little pressure to sell them on the part of proprietors disappointed with the outlook for the Republic, which seems to be slower than Brazil in overcoming the difficulties that arose in connection with the war. British Columbia issues are firmer, and there has been a little inquiry for Bombay Electric preference shares. The Calcutta Electric Supply report shows the fine net profit of £163,000, an improvement of £22,500 over the previous year. The dividend on the ordinary shares is retained at 9 per cent., the price is firm at 6⅜, and the 5 per cent. preference are 4⅜ middle.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1914.	Dividend 1915.	Price May 9, 1916.	Rise or fall this week.	Yield p.c.
Brompton Ordinary	10	10	6⅜	—	£7 8 2
Charing Cross Ordinary	5	5	8½	—	7 13 10
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	5	4	8½	—	6 8 1
City of London	9	8	11¼	—	6 14 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 14 8
County of London	7	7	12½	—	6 13 4
do. 6 per cent. Pref.	6	6	10½	—	5 14 8
Kensington Ordinary	9	7	5	—	7 0 0
London Electric	4	3	1½	—	7 6 4
do. do. 6 per cent. Pref.	6	6	4¼	—	7 1 2
Metropolitan	3½	3	9⅜	—	6 6 4
do. 4½ per cent. Pref.	4½	4½	8	—	7 10 0
St. James' and Pall Mall	10	8	6	—	6 13 4
South London	5	5	2⅞	—	8 18 10
South Metropolitan Pref.	7	7	1 1/16	—	6 14 0
Westminster Ordinary	9	7	6	—	5 16 8

Telegraphs and Telephones.

	Dividend 1914.	Dividend 1915.			
Anglo-Am. Tel. Pref.	6	6	99½ xd	+1½	6 0 6
do. Def.	30/-	33/6	21½	+ ½	7 15 0
Chile Telephone	8	8	6¼	—	6 8 0
Cuba Sub. Ord.	5	5	7½	—	6 13 4
Eastern Extension	7	8	14¼	—	*5 12 4
Eastern Tel. Ord.	7	8	14¼	—	*5 11 1
Globe Tel. and T. Ord.	6	7	12	+ ¼	*5 16 8
do. Pref.	6	6	10¼	—	5 17 5
Great Northern Tel.	22	22	8⅝	+1	6 0 7
Indo-European	13	13	49	−1	6 12 8
Marconi	10	—	2 3/16	+ 1/16	4 11 4
New York Tel. 4½	4½	4½	100⅞	—	4 9 4
Oriental Telephone Ord.	10	10	1 13/16 xd	—	5 10 4
United R. Plate Tel.	8	—	6	—	*6 13 4
West India and Pan.	1	—	1 1/16	− 1/16	9 6 1
Western Telegraph	7	8	14¼	—	*5 12 4

Home Rails.

Central London, Ord. Assented	4	4	67½	—	5 18 6
Metropolitan	1½	1	25½	—	3 18 6
do. District	Nil	Nil	18¼	— ⅛	Nil
Underground Electric Ordinary	Nil	Nil	1⅛	—	Nil
do. do. "A"	Nil	Nil	5/6	—	Nil
do. do. Income	6	6	85½	+ ½	*7 0 4

Foreign Trams, &c.

Adelaide Sup. 6 per cent. Pref.	6	6	47	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	3⅝	— ⅛	7 11 9
do. 2nd Pref.	5½	5½	3½	— ⅛	8 9 2
do. 5 Deb.	5	5	78	—	6 8 2
Brazil Tractions	4	4	55	−1½	7 5 6
Bombay Electric Pref.	6	6	10⅜	+ ⅛	5 15 8
British Columbia Elec. Rly. Pfce.	5	5	55	+2	9 1 8
do. do. Preferred	—	Nil	89	+2	Nil
do. do. Deferred	—	Nil	88	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 1
Mexico Trams 5 per cent. Bonds	—	Nil	41	+1	Nil
do. 6 per cent. Bonds	—	Nil	35	+3	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	32	—	Nil
do. 1st Bonds	Nil	Nil	41	+2	—

Manufacturing Companies.

	Dividend 1914.			
Babcock & Wilcox	14	22½	—	5 9 1
British Aluminium Ord.	5	22/- xd	—	6 7 3
British Insulated Ord.	15	10½	—	7 2 10
British Westinghouse Pref.	7½	48/-	+ 6d.	6 19 6
Callenders	15	11½	—	6 10 6
do. 5 Pref.	5	4¼	—	5 17 8
Castner-Kellner	20	8⅝	—	6 1 3
Edison & Swan, £3 paid	Nil	11 6	— 6d.	Nil
do. do. fully paid	Nil	1½	— ⅛	Nil
do. do. 5 per cent. Deb.	5	57	—	8 15 8
Electric Construction	6	16/6	+ 6d.	7 5 5
Gen. Elec. Pref.	6	9⅜	—	6 4 8
Henley	20	14½	—	*6 18 0
do. 4½ Pref.	4½	4	—	5 12 6
India-Rubber	10	10½	+ ½	*9 15 2
Telegraph Con.	20	36½	+1	*6 13 0

* Dividends paid free of income tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 10th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	1/8	..
a Ammoniac Sal	£70	..
a Ammonia, Muriate (large crystal) per ton	£54	..
a Bisulphide of Carbon	£23	..
a Borax	£28	..
a Copper Sulphate	£53	£4 inc.
a Potash, Chlorate per lb.	2/6	..
a ,, Perchlorate	2/-	..
a Shellac per cwt.	95/-	..
a Sulphate of Magnesia per ton	£18	..
a Sulphur, Sublimed Flowers	£14	..
a ,, Lump	£10	£1 inc.
a Soda, Chlorate per lb.	1/4½	..
a ,, Crystals per ton	190/-	..
a Sodium Bichromate, casks per lb.	..	..
METALS, &c.		
c Brass (rolled metal 2" to 12" basis) per lb.	1/5⅝ to 1/6	1½d. inc.
c ,, Tubes (solid drawn) ,,	1/6½ to 1/6¾	1d. inc.
c ,, Wire, basis ,,	1/5½ to 1/6½	¾d. inc.
c Copper Tubes (solid drawn) ,,	1/8⅜ to 1/9	1½d. inc.
g ,, Bars (best selected) per ton	£167	£18 inc.
g ,, Sheet ,,	£167	£18 inc.
g ,, Rod ,,	£167	£13 inc.
d ,, (Electrolytic) Bars ,,	£152	£11 inc.
d ,, ,, Sheets ,,	£170	£11 inc.
d ,, ,, Rods ,,	£159	£11 inc.
d ,, ,, H.C. Wire per lb.	1/7	1½d. inc.
f Ebonite Rod ,,	3/-	..
f ,, Sheet ,,	2/6	..
n German Silver Wire ,,	2/3	1d. inc.
h Gutta-percha, fine ,,	8/10	..
h India-rubber, Para, fine ,,	2/10	1½d. dec.
i Iron Pig (Cleveland warrants) per ton	95/-	..
l ,, Wire, galv. No. 8, P.O. qual. ,,	£36	£4 inc.
g Lead, English Pig ,,	£35 5	5/- dec.
g Mercury per bot.	£16 12 6 to £16 15	..
e Mica (in original cases) small per lb.	6d. to 8/-	..
e ,, ,, ,, medium ,,	8/6 to 6/-	..
e ,, ,, ,, large ,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire per lb.	1/8½	..
r Steel, Magnet, in bars per ton	£35	..
g Tin, Block (English) ,,	£207 to £208	£2 inc.
n ,, Wire, Nos. 1 to 16 per lb.	3/-	1d. inc.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Winnipeg Electric Railway Co.—The directors have decided to suspend dividend payments on the common stock for the present. The passing of the dividend, which came as a rather unpleasant surprise, follows successive cuts in the annual rate from 12 per cent. to 10 per cent. in March, 1915, and from 10 per cent. to 8 per cent. in January last. It is likely that earnings are in excess of the 8 per cent. requirements, but as earnings fell short of dividends by $85,388 in 1914, and by $388,898 in 1915, the company has probably extended itself financially, and will require some time to recuperate.—*Montreal Herald.*

Craigpark Electric Cable Co., Ltd.—For the year ended March 31st there was a net profit of £9,482 (after making provision for excess profits tax), which, with £1,147 brought forward, makes £10,629. The directors recommend placing to depreciation £2,500, to reserve £1,000, dividend on the ordinary shares at 6 per cent. for the year, leaving a balance of £2,028 to be carried forward (subject to payment of directors' fees). In spite of transport and labour difficulties and the high price of raw materials, the result of the year's trading has been good. The quantity of work on hand at the moment is satisfactory. The directors have made provision out of the profits for Excess Profits Tax. Annual meeting: To-day, at Glasgow.

Calgary Power Co.—The gross earnings in 1915 amounted to $289,613, an increase of $58,427. Net earnings, after deducting all operating and other expenses chargeable against revenue, amounted to $237,159, an increase of $56,952. Interest charges ($156,966) deducted leave $80,193, which has been transferred to surplus account.—*Financier.*

Capital Reduction.—*New Vanadium Alloys, Ltd.*—The reduction of capital from £25,000 to £1,875 has been confirmed by the Court.

Richard Johnson, Clapham & Morris, Ltd.—Out of the year's net profit of £32,215, 10 per cent. is paid on the ordinary shares and £20,000 is carried to reserve.

Brisbane Electric Tramways Investment Co., Ltd.—After paying a further dividend of 4 per cent., making 8 per cent. for the year, £34,292 is to be carried forward.

Merthyr Electric Traction & Lighting Co., Ltd.—After placing £1,000 to reserve and paying 7 per cent. on the ordinary shares, £906 is to be carried forward.

FROM THE POWER-HOUSE WINDOW.

BY "ROVER."

I BELIEVE it was Mark Twain who designed his house with the kitchen windows looking out into the street. He declared the kitchen to be the most important room in the house, and said further that his cook would work better with a cheerful view before her than if she had only other kitchen walls to look at. Perhaps Mark's philosophy does not apply to power houses, but I think I understand his cook's point of view.

My first station experience was in a Midland town. The windows were so high up that only the sky could be seen, but, Heaven be praised, there was a door which opened direct upon a lane, not a very respectable lane, but one in which human beings disported themselves. They looked in our open doorway, stared at our strange machinery, asked foolish questions, and somehow shortened our night hours. Across the lane was the back of a large hotel, with the "club-room" just opposite our door, and occasionally we would hear "A Jolly Good Fellow" sung with fervour or would listen, without invitation, at a "smoker"; but the hand of progress was against us. Our chairman reported "The extensions made necessary by the increasing demand on our plant have now been completed, and the two new big 200-KW. sets and switchboard have been installed in the new engine room." Good-bye to the door which opened into the lane!

Next, a seaside resort. The power house here was placed, not on the front, but some distance inland. On one side of us we had a mortuary, and on the other, a cemetery. In the summer the mortuary was fairly busy, as this particular resort was found very convenient for purposes of suicide by distressed Londoners.

I think my next point of view was even worse—a small town in Ireland. Here we had no outlook at all, but a high wall separated us from the public abattoir, and every day we heard the death cries of countless pigs. I do not think centuries in Ireland would accustom me to the last shrill agony of the pig.

From Ireland to America was a natural change—a power house, hydro-electric, with many windows, seven miles from a town, in the heart of the Ontario bush. The camp, containing about a dozen souls, stood at the crest of a hill in full view of the men on duty, but too far off for a man to be distinguished. We rarely saw a stranger from our many windows—nothing but trees, trees, trees, and but two varieties of trees, the pine and the birch. We felt almost grateful when the bush fires started to devour whole acres of the accursed trees, and for a day or two we watched the smoke with some satisfaction. Later on, when the camp was threatened with extinction, we changed our minds as to the usefulness of bush fires. At night, the power-house men had to watch the flames and give the alarm if the fire came too close, in which case all the residents of the camp were to take refuge in the power house—the only non-inflammable building. I remember my wife made a parcel consisting of all our jewellery and three cans of evaporated milk for the baby, and we considered ourselves prepared for the worst, which, luckily, never came. I do not hope to watch another bush fire from a power house window. As it was, our transmission lines were burnt down for half-a-mile.

At another plant, about 100 miles further north, I had a similar outlook of bush, but, although the nearest town was 20 miles away, we got more passers-by. This was in the gold district, and many prospectors were looking out for precious metal. They came in twos and threes by canoe, and were generally very uncommunicative as to the locality in which they expected to make their "lucky strike." They would discuss every other subject discussed by civilised or barbarian man. They were nearly all American, and all most interesting talkers, and I came to the conclusion that prospecting for gold greatly stimulates the imagination. Usually they came just before the mosquitoes made bush life unbearable, disappeared for three weeks or a month, and returned with depleted knapsacks. They gave us a cheerless recognition at the power-house door and hurried home.

The Indians had even less to say. At certain times of the year whole tribes move to other hunting grounds, and there would be a procession of canoes past our door. The men and boys were nearly all dressed in dungaree overalls, but the squaws and girls had a passion for vivid colours. They all handle a canoe perfectly, and to see them shooting a rapid is a sight worth while.

We used to catch some decent trout from our power house windows, and some monster pike, too. Sometimes we would see a bear, and more rarely a moose, although early one morning a big bull moose so far forgot himself as to swim across our tail-race. In winter, we had little but snow to see, but an occasional Indian dog team or a couple of Indian hunters on snow-shoes would break the monotony.

Back to a London central station in fog-time. Nothing outside to be seen—not even the other end of the engine room could be properly distinguished when the usual fog was in evidence.

Last of all sunny Spain—all, all too sunny. From our windows, a vista of bare red rock, but with one precious green spot where a Spaniard has, with infinite labour, made an orchard. Close to the orchard is a spring of drinking water, and from the power house can be seen Spanish girls, each bearing on her head the heavy "cántara" or water-bottle of precisely the same design as those used by the Mediterranean race of how many thousands of years ago.

THE LJUNGSTRÖM TURBINE AND ITS APPLICATION TO MARINE PROPULSION.

BY ROLAND S. PORTHAM.

(*Abstract of paper read before the* INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.)

(*Concluded from page* 522.)

Fig. 10 shows the outer blade-rings of the 10,000-B.H.P. machine, and the rigidity of the structure is clearly apparent. The cylindrical stress caused by the lineal velocity in the 10,000-B.H.P. size is moderate, and the factor of safety is ample. Fig. 11 illustrates the complete 10,000-B.H.P. turbo-alternator and condenser. The overall length is 24 ft., height from bottom floor, including condenser, 21 ft., and weight of turbo-alternator 60 tons.

The overhang of each generator frame is supported by a pair of steel ties, each connected to the foundation through a stiff spiral spring or buffer, which effectively prevents any tendency to hogging in the event of any difference of temperature between any portion of the casing.

My endeavour has been to show the symmetry and compactness of the design and the care taken to eliminate any traces of distortion due to temperature changes, so that the highest possible temperature of superheat can be used. The fact that the steam velocity is at its lowest when the temperature is greatest is in marked contrast to the ordinary type of turbine, either of the impulse or impulse reaction type, where maximum velocities and maximum temperatures are invariably associated.

The whole turbine has been so designed as to be manufactured in ordinary lathes, such as may be found in any modern engineering shop. The fitter is almost entirely replaced by the turner. The manufacture of the blade rings is ordinary repetition work, to which unskilled boy or girl labour can be trained in a few weeks. The completed machine has a factor of safety larger than in any other type of turbine. Blade stripping is unknown, due to the mechanical construction of the rings, the blades being firmly held at both ends.

SOME STEAM TRIALS OF LJUNGSTRÖM TURBO-ALTERNATORS.

Date of test.	Normal max. output in KW.	Trial output in KW.	Steam per KW.-hour, lb.	Pressure on turbine inlet (absolute) lb. per sq. in.	Superheat, degrees Fah.	Vacuum per cent.	Thermodynamic efficiency compared with ideal engine, per cent.
1911	1,000	1,000·6	11·6	168	302	96	76
1914	1,000	990	12·7	160	150	94	77
1915	6,000	2,000	11·1	170	270	97	79
1916	3,000	2,700	11·15	160	280	88	87

Attention is called to the remarkably good results shown by the 3,000-KW. turbine at 90 per cent. full load. Reduced to marine conditions of 220 lb. boiler-gauge pressure per sq. in., vacuum 95 per cent., and 240 deg. F. superheat on the inlet valve, the steam consumption of the turbine would be 7.25 lb.

per B.H.P. per hour, or 8 lb. per S.H.P. per hour, including generator and motor losses, but excluding condensing and propelling auxiliaries. With electrically-driven auxiliaries, and including excess steam tapped from the turbine at 30 lb. pressure for feed-heating purposes, this would represent a total propelling steam consumption of 9 lb. per S.H.P. per hour, equivalent with coal of 14,000 B.TH.U. and an actual evaporation of 10 lb. of steam per lb. of coal with 210 deg. F. feed temperature, to 0.9 lb. of coal per S.H.P.

It might be said that trial conditions of consumptions may not be maintained in practice, due to possible wear of the labyrinthic edges which vary from .004 in. to .01 in. in the different radii of the blade rings. It has been found, however, that there is no perceptible increase in consumption. Recent trials carried out with the 1,000-KW. set installed in 1913, at the North Metropolitan Power Station, Willesden, show no increase on the original consumptions after a period of two years' continuous operation for 18 hours a day.

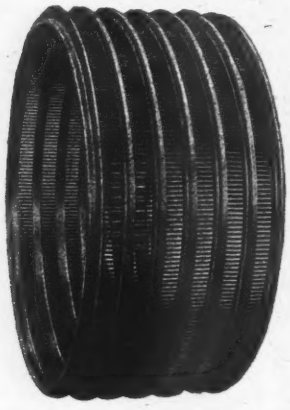

FIG. 10.—OUTER BLADE-RINGS OF 10,000-H.P. TURBINE.

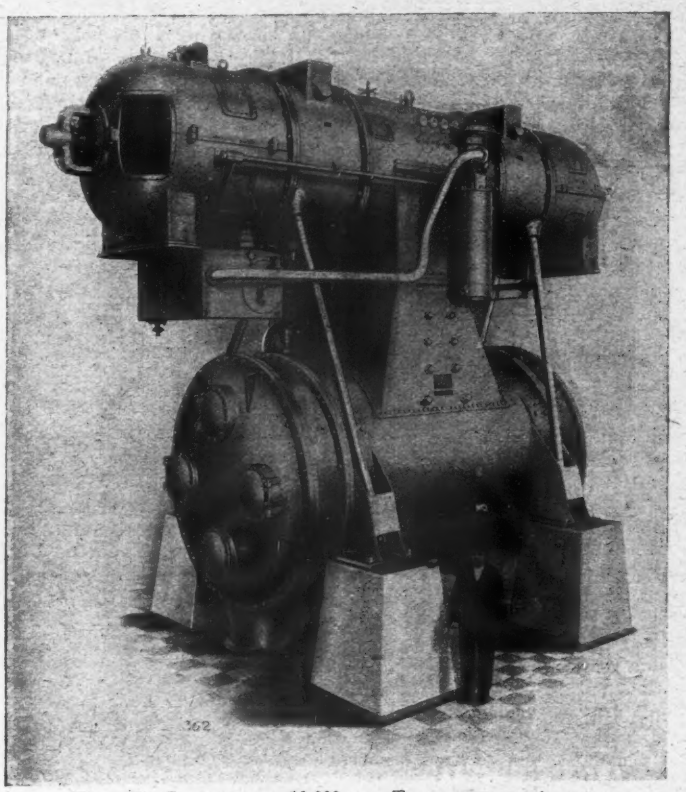

FIG. 11.—LJUNGSTROM 10,000-H.P. TURBO-ALTERNATOR AND CONDENSER.

Comparison of the *Mjölner* and the *Mimer* shows that—

1. There is a relative trial fuel economy of 42 per cent., and fuel economy in service of over 38 per cent. in favour of the former.

2. The machinery weight and space shows a relative reduction of about 25 per cent.

3. As regards capital cost, if the propelling machinery in the electrical ship is more expensive for smaller powers than in the equivalent reciprocating ship, it will be found that the diminished fuel consumption, weight of propelling machinery, and resultant increased cargo-carrying capacity should in normal times repay the additional cost of the installation in a period of under two years.

4. In respect of maintenance, the experience of sixteen months' running of the *Mjölner* has proved this to be extremely low. The cost of upkeep of the turbines, motors, and gearing has been practically nil.

5. During the period under review, the ship has not required to stop through any defect of the main propelling machinery; this is a pioneer installation, and the entire absence of breakdown must be considered a satisfactory feature.

As reversing is effected on the motors, an astern turbine is

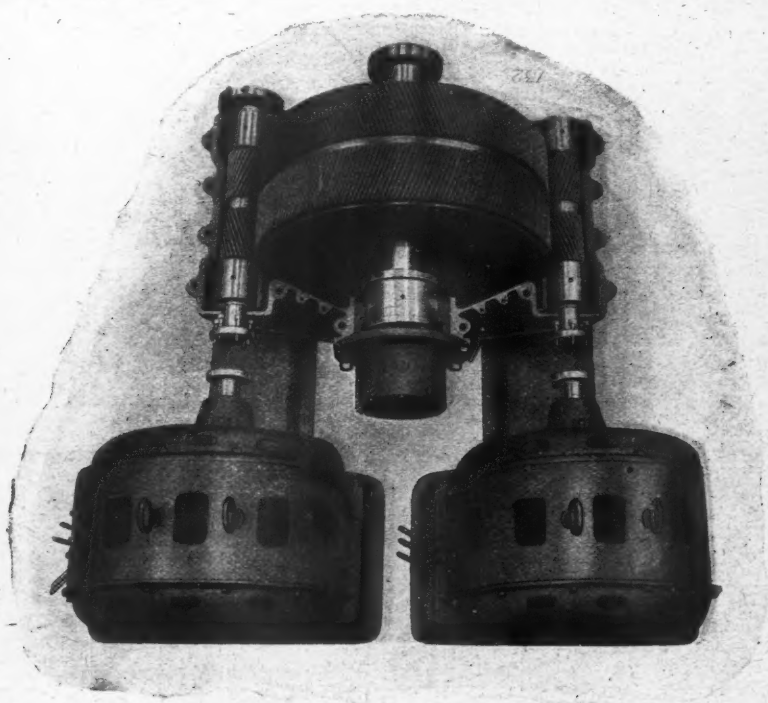

FIG. 12.—VIEW OF MOTORS AND GEARING.

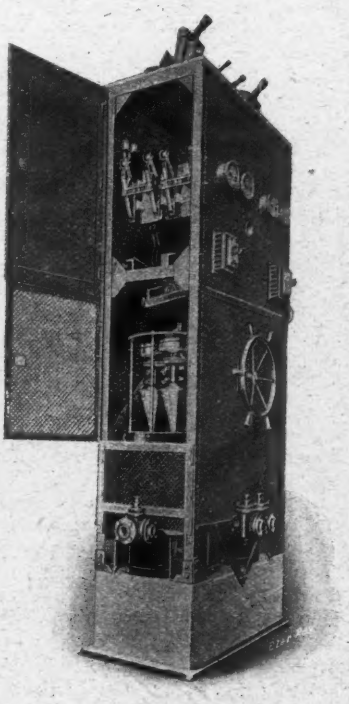

FIG. 13.—CONTROLLING GEAR.

dispensed with. The prime mover runs under the best possible thermal conditions, which include as high a superheat as can be commercially obtained without unduly sacrificing the efficiency of the boilers. The gain in thermal efficiency due to such increased temperature eliminates the electrical conversion losses. Further, the Ljungström electrical method of propulsion, in conjunction with mechanically-geared motors, is a system which embodies the maximum degree of reduction between prime mover and propeller shaft, whilst the total weight of engine-room machinery is lower in the smaller powers and not greater, even in the larger powered merchant ships, than any form of mechanical reduction with the ordinary impulse or impulse-reaction turbine. The reduction in weight of boiler-room machinery is obviously in direct proportion to the steam consumption of the propelling plant.

To have at least two independent turbo-generators of equal power for each marine installation is advisable, not only in respect of the factor of safety through such duplications, but also in regard to the economy to be derived therefrom when running at reduced speeds. There is no necessity, however, in any class of merchant ship to increase the weight and expense

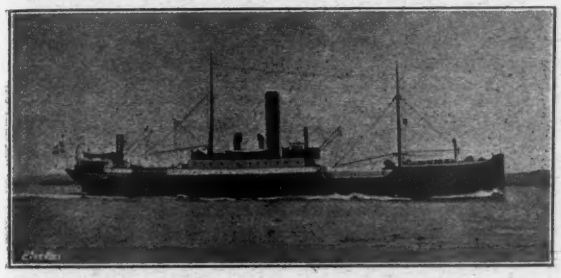

Fig. 14.—S.S. Mjolner.

of the motors by pole-changing devices. To run at half speed or about one-ninth power one of the two generator sets would run at half speed, absorbing about 25 per cent. of its normal full power. Between three-quarters and full speed, both sets are run in parallel at speeds corresponding to these two requirements, consequently the turbines run under at least as efficient conditions, and with the same elasticity, as in the case of ordinary geared turbines where the regulation is effected on the throttle or nozzles of the turbine.

The reversing switch and its resistances need only be used when manœuvring astern; the whole of the regulation from dead slow to full speed and *vice versa* can be effected on the turbine. The motor speed falls in direct proportion to the reduction of speed on the prime mover.

Twenty-one ships of an aggregate S.H.P. of 32,000 are at present under construction on the Ljungström turbo-electrical system, for British, Russian, Japanese, Swedish, Norwegian, and Danish owners. These vary from ocean-going vessels of 5,400 S.H.P. to river steamers of 550 S.H.P. They include one light-draught paddle steamer of 1,500 S.H.P., the power being transmitted from the turbo-alternator to two electric motors

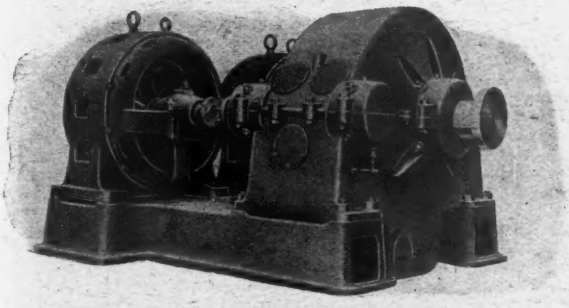

Fig. 15.—Motors and Gearing, Complete.

running at 450 R.P.M., each geared by single reduction to the corresponding paddle-wheel shaft, which runs at from 35 to 40 R.P.M.

In an appendix, a brief description is given of the Ljungström turbo-electrical propelling plant fitted in the *Mjölner*, and particulars are furnished of the comparative trials of the *Mjölner* with her sister ship *Mimer*, the latter possessing reciprocating engines.

These two ships, each of about 2,250 tons displacement, were ordered in 1913 for coasting trade, and delivered to their owners at the end of 1914. The following guarantee was given:—

On trial, the consumption per I.H.P. (equivalent) per hour of the electrically-propelled vessel should not exceed 70 per cent. of the consumption per I.H.P. per hour of the standard triple-expansion engine of the other vessel under equal conditions, excepting that the turbo-electrically driven vessel should have the benefit of the reduction in weight of machinery as regards draught.

The actual trial consumption showed that the *Mjölner* only consumed 58 per cent. of the fuel of her sister-ship. During a period of six months' service conditions, the owners have certified that the coal per ton mile consumed by the *Mjölner* was 62 per cent. of the coal consumed by her sister-ship for the same period.

The table below shows some of the trial results.

There are two turbo-generator sets in the *Mjölner* which run at 7,200 R.P.M., and supply three-phase alternating current at 500 volts, 120 cycles per second. The maximum load is approximately 400 KW. per generator unit—*i.e.*, 800 KW. for the complete installation. The over-all length of the turbo-alternator is 10 ft., the external turbine blade ring 15 in., and the weight of the turbo-alternator 7 tons.

The generating plant has been designed so as to avoid any possible trouble from salt or dust deposited on the generator stator or rotor. The generator rotor contains no air ducts. The stator air-ducts are straight, and, consequently, easily swept without removing or dismantling any other portion of the plant.

Mica only is used for the insulation of the rotor windings, which are consequently able to withstand a considerable amount of overload without injury.

The condensers, of a modified contraflo type, easily maintain a vacuum of 97 per cent. in service with a sea temperature of 65 deg. F. This high vacuum is in part due to the efficiency of the air-pump plant, and in part to the care which has been exercised in obtaining an air-tight condenser. No auxiliary engine exhausts are led into the main condensers, and where outlets are unavoidable water locks have been fitted to exclude the entry of outside air. An electrically-driven vertical centrifugal pump draws the condensate into the kinetic tank.

The condensate from the feed heaters is led to the main condensers through additional small heaters in series with the main feed-pipe.

	Mimer.	Mjölner.
Total boiler-heating surface	3,150 sq. ft.	2,140 sq. ft.
Weights: propelling machinery, tons ... — Engine-room and tunnel 76	55	
Weights: propelling machinery, tons ... — Boiler-room ... 110	81	
Weights: propelling machinery, tons ... — Total ... 186	136	
S.H.P.	730	843
Revs. per minute ...	86	89
Displacement... ...	1,698	1,648
Speed (knots) ...	11·3	11·7
Boiler pressure ...	180 lb.	220 lb.
Draught	Natural	Howden's ⅛ in. in ashpit.
Superheat	Nil	190° Fah.
Feed temperature ...	180° Fah.	230° Fah.
Vacuum (bar. 30 in.)...	26½ in.	29 in.
Coal consumption per day of 24 hours ...	13·1 tons	9·4 tons
Per S.H.P. per hour ...	1·798 lb.	1·036 lb.
Calorific value of coal	13,498 B.TH.U.	13,485 B.TH.U.
Moisture, per cent. ...	4·1	2·2
Ash, per cent. ...	3·6	5·0

The circulating pumps are three in number, each electrically driven by direct-coupled motors running at a speed of 3,600 R.P.M. The current is supplied from the main generators. The air-pump system is of the kinetic type.

One electrically-driven rotary multi-stage feed-pump is supplied for each generator unit, each capable of feeding both boilers under full power. The power taken by the feed pump is less than 1 per cent. of the total shaft horse-power. The pumps deliver the water to the boilers through feed heaters of the inverted-condenser type.

The propelling motors are of the standard three-phase induction type with slip-rings, and run at 120 periods, 900 R.P.M. and 500 volts. They are connected with the driving pinions by means of slipping clutches of a novel design, which are constructed to prevent breakage of propeller blades or shaft in the event of the propeller fouling block ice or any similar obstacle.

The gearing is of the helical type. The pinions are of chrome nickel steel, and the wheel of forged carbon steel. The shafts carrying the pinions run in fixed bearings of the same type as the rotor bearings; they are designed for minute adjustment, with great rigidity. Fig. 12 shows the two pinions, wheel, and one-half of the gear case, which is fitted to a box section bedplate on which the two motors are supported.

Owing to the motors and gearing, fig. 15, being on a common bedplate, the plant as a whole is self-contained, and all adjustments can be made at the works of the manufacturer. The lubrication of the gearing is effected by a separate oil-pump delivering the oil to the bearings and to the teeth under pressure. The gearing runs perfectly cool. The speed of the teeth is low, about 27 ft. per sec.

A Michel thrust bearing is mounted on the forward side of the gear casing.

Manœuvring is effected by the hand wheel shown on the switch-box illustrated in fig. 13. If the hand wheel is moved from the central stop or mid-position in one direction, the propeller turns in a similar direction, its speed corresponding

to the angle through which the wheel has been turned. About 120 deg. represents full power ahead, and 120 deg. in the other direction represents full power astern.

Regulation of the speed of the motors when reversing is effected by inserting in series with the rotors of the motors resistances of the liquid type. These resistances consist of two sets of cones, of which the lower ones are stationary and filled with a saline solution, whilst the upper cones are mounted on vertical spindles which can be raised or lowered into the lower cones by the hand wheel, thereby inserting a greater or lesser resistance in the circuit. In mid or stop position, the upper cones are lifted entirely out of the liquid and lower cones; thereby the circuit is broken and the motors come to rest. At full speed the two cones come nearly into contact, the resistances being simultaneously cut out through a short-circuiting switch.

Reversal is effected with the wheel in mid or stop position —that is, when the rotor is open-circuited—and is accomplished by a change-over switch which reverses the phases in the main or stator current. A solution of dilute potash is used as the liquid resistance. This solution is circulated and cooled by a small centrifugal pump which is mounted on the same spindle as the circulating pump. The cones are of nickel and thus non-corrodible, and are counterbalanced, so that the power required to turn the hand wheel is nominal.

The switches are of the ordinary open type, the pressure in the rotor current of the generator being automatically lowered before the circuit is broken; they are found to work perfectly satisfactorily. For larger powers, oil switches are used.

The elasticity of control is considerable, the speed of the propeller ranging from about 12 R.P.M. to 90 at full speed. The total time of propeller reversal from full speed ahead to full speed astern was carefully tested on the trial trip of the *Mjölner*, and averaged fifteen seconds.

LABOUR DEMANDS AND RESPONSIBILITIES AFTER THE WAR.

(Some Mistakes Which Must not Recur.)

By JOHN MARKS.

One of the best features of the Electrical Review is that it appeals to the workmen of the electrical industry as well as to the most advanced scientific workers who are busily engaged in furthering new ideas and advances in the matter of applying electricity to ever wider and more varied uses.

This being the case, the writer considers that if a short time is spent in consideration of mistakes which in the past have not only tended to embitter workmen and their employers, but also to injure seriously the calling by which they both obtain their livelihood, it may have a really good chance of influencing the more thoughtful workmen to take a more reasonable view of the difficulties under which the manufacturer works; to realise that in any struggle between the manufacturer and themselves they must necessarily come off a bad second; and to hope that the influence of such men may have a deterring effect on the more erratic and hot-headed portion of their fellows.

The writer proposes to point out where, in the past, the workmen in various engineering trades have allowed themselves to be badly injured by following out the usual policy of antagonism towards the manufacturer in season and out.

The latter expression is purposely used, for the writer's own personal experience teaches him that too often the attitude of suspicion has had its rise in dealings, which were far from fair, on the part of manufacturers of an older school, who, for the most part, are now gone from us for ever.

Why should the unfair methods which obtained in days gone by make the workman suspicious of an employer who wishes to-day to treat him fairly? Why should the good and skilful man be forced to work, and work hard, for no greater return than the mediocre man, or even the duffer, who, in times of good trade, must be employed?

It is often stated, from the workmen's side of the question, that the demanding of a minimum wage, and the utter refusal to work on some type of piece or bonus system, does not prevent the manufacturer from rewarding a smart man with greater wages than the poor man. This, however, is quite a fallacy; the manufacturer has to average the cost and output of each man he employs when he is making up an estimate of what any particular contract will cost. He now pays all men the same level rate, and the good man must restrict, and does restrict, his output, in order not to show up the slower and less skilful man. Thus the manufacturer only gets a meagre output compared to what might be possible; he is not only compelled to refuse to pay the smart man a better wage, but, in order to face competition, he is also bound to take such precautions in the matter of providing supervision, that the slower man is kept constantly at his work, and is, in fact, made to accelerate his output to a degree which for him is uncomfortable, in order that the total cost for labour on any contract shall not be so heavy as to be prohibitive. The writer speaks from practical experience of both sides of the question.

Apprenticed to a firm who would not allow its premium men to idle, but forced them to work, or cleared them out, the memory of the work in the shops, though very pleasant, has this thought constantly at the back of it. The almost hopeless nature of the state of a man, who perhaps gifted with good brains and clever fingers, is compelled to go on year after year turning out so many parts per day, often of the same machine, and sometimes of one style and size, for a wage at the end of the week which will be the same when he is 50 as it was when he was 25. Surely there is some way of remunerating a man's skill and the result of his accumulated years of experience; and what better form could this remuneration take than extra wages, which would contribute to his everyday comfort, and tend to make him a more independent member of society, as well as to render him much more valuable to the community as a whole?

It may be said that the smart man will always rise from the bench or machine; that, however, is not true, in that we cannot all hold supervising and managerial positions. The correct policy then is to make the prospect before a workman better than it has been in the days before the war. The most important member in this matter is the workman himself.

If he will, he can raise himself to a far higher plane than he occupied before the war, and he can make his own position more certain and less liable to attacks of short time due to bad trade. This can only be accomplished if he assists the manufacturer by turning out a greater volume of work per man, and by assisting and not hindering the turning out of much more work from every individual machine used.

The level at which wages now stand cannot be maintained after the war unless the workman will consent to work with the firm and look upon the well-being of the firm as his very particular and personal interest. The writer is stating no mere empty platitude when he calls attention to the fact that the manufacturer has gone as far as he can in helping the workman; any further help must come from the workman himself, or it will not come at all.

It may be asked, what is meant by the idea of the workman helping himself, and the employer being unable to help him further.

The matter is simplicity itself; before the war, people who had money to invest, first asked about the security of the trade they intended to put their money into; next they wished to learn the probable dividend they might reasonably expect would be payable year after year. After some such inquiry, they very often decided to invest their money otherwise than in the electrical trade. Why? Because they could see but little in the way of good dividends paid throughout the trade as a whole, and also because they noted that in many cases the capital invested was none too safe; that is, a share bought for £1 to-day, stood a good chance of being only valued at 18s. in the course of a few months or a year or two.

People who advise persons who are about to make investments, would always draw the attention of their clients to the element of risk in the engineering, and particularly in the electrical engineering, trade.

Now these matters may not appear to affect the workman, and far too many men declare that they do not and cannot affect him.

They do affect the workman, however, because when such a state of things occurs in any industry, it becomes difficult to obtain capital with which to put down fresh machinery, or to erect new works. In order to attract sufficient capital, the management of such an industry must promise, and must pay, a somewhat high return on the money invested. Thus the works must now earn a greater margin than ever between the cost of constructing and selling its products, and the price it receives from the customer; as the manufacturer is subject to keen competition, he is forced to speed up the output of his men. There is no other explanation of the matter, he is absolutely forced to make the men work at a hot pace, in order to preserve the industry by which they both earn their livings.

Also we have the spectacle of the workman's adviser, whether he be his Trade Union representative, or the leader writer in the labour paper to which he subscribes, stating that all piecework or bonus work systems, are methods of inducing the workman to *sweat himself*. Let us suppose for a moment that they are for this purpose; it will at least be admitted that at the end of a self sweating week, the wages packet is considerably heavier, than under the ordinary datal system of paying wages, and to that extent the workman is a considerable gainer. Under the present system, the Trade Union rules actually make it imperative for the master to drive his men, if return for a smaller wage than they might easily earn by using their skill, experience, and brains, for the purpose of expediting their output; and every man knows that when a workman has a direct monetary incentive to turn out more work, he does not feel the speeding up, simply because he does it willingly; whereas at present he is kept to his task whether he wishes or not.

Now let us take a glance at what will be the after-war conditions of our industry, in relation to the obtaining of sufficient capital. It is no use arguing that the State should own the means of production and exchange; the State does not own them, and will not do so for many a long year, if ever. Meanwhile both the manufacturer and workman have to live, and whilst it is a fact that most manufacturers could get a fairly comfortable living if they retired from trade and invested their money in Government securities, it is equally true that not one workman in 10,000 can so exist, simply from lack of capital.

Thus, for the present, we depend on capital flowing into the industry, in order to make a living possible for anyone.

Before the war a man could get, with safety, 4 per cent. on

money he invested with municipal or equivalent safe concerns. He put his money into business because he anticipated making a clear 8 or 10 per cent. out of it. In some cases he preferred to take 5 or 6 per cent. in order to be a little safer, but he always demanded considerably more than the safe rate of 4 per cent. In short, he would not take risks for the sake of an extra 10s. per cent. dividend.

The manufacturer not only looked to this return on his invested money, but he recognised that by using his managerial abilities in a trade in which he had some degree of interest, he could earn for himself a good salary as a manager. Thus, such a man has everything to persuade him to enter and keep in business, and will often do so when the return on his invested capital is really low. The shareholder, however, has not this double interest, he is interested only in the dividends earned, and will not bring his money to the industry if the return is low; as this man is the person who finds the majority of the necessary capital, he must be considered, or the business goes to the wall for want of money to work with.

It is quite certain that after the war people with money to invest will be somewhat scarce, and that they will require a high return on their money, simply because they can obtain Government security with a dividend of 5 per cent.; if they are to take the risks of an industry subject to keen competition, they will require much more.

Also, the manufacturer with money and ability will, if the returns of business are meagre, simply refuse to be subject to the worries inseparable from the management of a large business; he will save himself worry, improve his health, and prolong his days by the simple method of investing all his money with the Government, and none in industry.

The writer makes no philanthropic claim for the manufacturer, he simply states what will be the policy dictated by common sense; no man in his senses is going to submit his capital to the risks of business, and himself to heavy and responsible duties, unless he is able to get a good consideration for so doing.

Now in every dispute between the workman and the employer the workman is at a disadvantage, owing to the fact that the employer can, and the workman cannot, live without working; consequently, it should not be necessary to point out that only in the greatest extremity should the workman resort to a strike, simply because it injures him and those dependent upon and connected with him to a far greater extent than it can ever injure the employer.

Take a recent case when a few years ago the late secretary of the A.S.E. advised the men on the North-East Coast not to strike; they threw his sound advice in his teeth, and, as usual, dubbed him traitor. Mr. Barnes knew both sides of the question, and, on that account, he advised the men not to strike. He was publicly flouted and insulted, and as a consequence resigned his position as secretary.

The strike lasted nine months, and the men went in on the employers' terms, after subjecting their wives and children to the misery and serious privation of a long strike, and the wicked wasting of sufficient capital to bring in an income of over £10,000 a year at a 4 per cent. rate.

During the great coal strike of a year or two ago over the minimum wage, the proprietor of certain iron mines, asked permission from the Miners' Union, to obtain sufficient coal from his own pits in order to keep his blast furnaces going.

This situation was somewhat peculiar, and is thus more interesting. The owner of the iron mines was a member of a family who had worked those particular furnaces for over 130 years; he was on the best of terms with his men, and owned valuable coal pits 5 miles away. The iron ore he raised was so good that he had received many offers from iron masters in different parts of the country to buy the ore from him at a price which would have left him a much greater profit than he obtained from the iron run at the blast furnaces. He was a very wealthy man, and to the writer's knowledge refused three times to sell the ore instead of smelting it, on the grounds that the furnaces were going to be worked by him as his family had worked them before him.

His proposition was that he should pay for a check man at his coalmines who would see to it that no coal went from the mines other than to the blast furnaces; every man employed on working coal for this purpose was to be paid a lump sum at the end of the dispute, which would have represented the agreed increase of wages from the start of the trouble; that is, any advance obtained was to be made retrospective.

In vain did this owner plead that if the miners persisted in shutting down the furnaces, they would throw out of employment 200 men who were comfortably situated, and in vain did he point out that every man working coal for those furnaces would be paying into the Union funds, instead of drawing from them. So serious did he consider the matter, that he addressed mass meetings of the local men, in order to lay the proposition before them. Finding nothing but stubborn rebuffs, he warned the men that if they shut the furnaces down, they would not be started up again in his lifetime; neither persuasion nor warnings had any effect. The furnaces must close in order that as far as possible the whole nation should suffer and sit up over the coal strike.

The furnaces were shut down; the strike progressed, and ended. Knowing members of the strike-mad section of the community waited for the furnaces to start up again, and even gave the dates of the restart. The iron ore men certainly restarted, and then loaded the stuff into the railway wagons, to go away and be smelted elsewhere; the offer of other iron masters had been accepted, and 200 men were done out of a comfortable living by the unparalleled folly of their own class.

The critic may retort, that as the smelting had to be done elsewhere the men were not done out of a living. It is true that those who still possessed their youth and pluck packed up and followed the ore, after waiting about for a month or two to see what would happen. Finding their resources absolutely at an end, they sought work elsewhere, and found it—not amidst the country surroundings of the old place, but in the dirty and high-rented quarters of a large industrial district. The writer's contention therefore that they were done out of a *comfortable* living is quite correct.

Some of the men who did not wish to leave the district, and who had one or two permanent ties in and around the locality, were forced to take up any sort of a job that they could find.

The writer will not easily forget the spectacle of a healthy man of about 45 asking a relative for a labouring job at an adjacent works, and stating that his family obligations would not permit him to remove; that he had been provident and made some provision for bad times and old age, but that work he must have if he was not to start realising his capital, which consisted of two cottages, and an excellent plot of gardening ground.

This man plainly stated that he had worked for the iron company for over 30 years, that he had never had any quarrel with them, and that the miners' attitude had thrown him absolutely on his beam ends.

This man was no slacker, and no fawning humbug; his frugal investment made it impossible for him to follow the iron ore without great sacrifice, and an objectionable change for his family and himself, into a dirty industrial district. He was willing to walk, and did walk three miles from his home to the next works which could offer him even a pittance, providing that he could stay where his interests were.

Thus folly on the part of one section of men brought distress to another section of working people; distress of a permanent nature. The greatest folly of the whole matter was that the man they had worked for was admittedly a thorough gentleman, and a most considerate employer.

This last statement brings the writer to his final argument. Why should workmen so often tantalise and aggravate those firms which treat them best? This is simply folly of the worst description, and if persisted in will ultimately throw all control into the hands of the less desirable type of manager.

Let anyone with extensive experience of municipal control think of the manner in which advantage is taken of the known sympathy of the Council towards the Trade Unions; this experience, like those mentioned above, has been personal with the writer, and is no hearsay matter. Often has the question been asked, "Why do you not leave us alone instead of badgering us in this fashion?" "Why do you not annoy some of the worst paying firms in the town until the management there gives you something like what you get here, both as regards wages and conditions of work? Why do you follow a stupid policy which must alienate men with a friendly feeling towards you?"

No satisfactory answer is usually offered, except that it is considered good policy to squeeze where squeezing can be done; and so the shortsighted game goes on, and results in the opposition to Trade Union methods spreading even to those officials, who in theory have at one time approved the Unions.

The plea is advanced that ideal conditions will bring out the best in the worker; this is absolutely incorrect.

Let us take an example of an industry run by working men themselves for their own benefit. The reference is to the factories run by the Co-Operative Wholesale Society.

This society is not only up-to-date in its manufacturing methods, but its constitution insists that full Trade Union wages shall be paid, the shortest possible hours worked in return, and that the best of conditions must be maintained for the workers in those factories.

Now do we find unalloyed contentment in those places? The answer is in the negative; on more than one occasion strikes on trivial and absolutely piffling matters have broken out and caused annoyance and loss to the management.

Again, taking the retail side of that same movement, the writer knows of discontent obtaining amongst a number of employés who are paid above the district rate for their labour, and who work many hours less per week than the ordinary shopmen. Yet here, again, we get the pettifogging, annoying manufacturing of petty grievances, which could enter the mind of no man who was busy with a fair day's work.

In one instance in a large town, the managing Committee, mostly composed of working men and Trade Unionists, were so disgusted and hurt at the spirit displayed towards them by a well treated set of employés, that they placed their regret in writing on the minutes of that particular society.

In conclusion, the writer assures the workman that no way of improving his status and pay will avail permanently other than that of assisting the employer to reduce the cost of manufacture. This he can do by agreeing to work on a bonus system whereby he turns out more work in a given time, and receives more money for doing so.

The manufacturer's share comes from the fact that the charges for rent, rates, taxes, cost of maintaining the establishment, lighting and running, are very heavy. More work turned out means a lower standing or dead charge on each finished article, and a quicker realising of the profit thereon. Thus a smaller profit can be taken on each article because it is taken on more articles per year.

The cost of each article is reduced by the time saved, and the cost to the customer can, therefore, be reduced; by following the above method of intensive production, the customer gets a lower price, the man a greater wage, and the manufacturer a larger profit.

If works A can make an engine of a certain type for £100, and works B cannot make it for less than £120, then works B will

have to shut up. Apply the comparison to countries A and B with regard to the whole of their manufactures, and it follows that country B will have to go down.

& Which we are to be is in the hands of our workmen. If they will try to abolish old time suspicion and work hand in hand with the manufacturer to speed up output, both the country and themselves will benefit by long-continued prosperity; and under such a system the present rates of wages could be maintained after the war has finished.

The war will not finish to-morrow, but to-morrow will be too late to consider the matter. It must be considered now, and with an open mind.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CHILE.—With reference to the announcement in the REVIEW of March 17th respecting a proposed new specific Customs Tariff for Chile, it appears that the enactment of the new Tariff has now been reported (by cable on April 16th) by H.M. Minister at Santiago, who states that merchandise cleared through the Customs within 30 days of the promulgation of the new Tariff will be assessed for duty at the old Tariff rates, notwithstanding that the new Tariff will, in principle, take effect from the date of promulgation.

JAPAN.—The Government Bill proposing to modify the Customs duties on various articles imported—see the REVIEW of April 21st—has now been passed by both Houses of the Diet, and was promulgated in the *Official Gazette* of March 6th. The new rates of duty provided for by this measure came into operation on April 15th.

FRANCE.—A Government Bill has been laid before the Chamber of Deputies, proposing to authorise the Government, so long as hostilities continue, to prohibit by Decree the importation of foreign goods, or to increase the Customs import duties thereon.

FRENCH INDO-CHINA.—Owing to the difficulties experienced at the present time in regard to the shipment of goods from the United Kingdom to Indo-China, the French Government have decided that, subject to the necessary "authorisation" being given by the French Consul-General in London, the "Minimum" Tariff rates of duty will be applied during the continuance of the war to all British goods forwarded from the United Kingdom to Indo-China, whether in British or French bottoms, with possible transhipment at Marseilles, Singapore, or Hong-Kong.

The above-mentioned concession is in addition to that notified in the REVIEW on March 10th, under which transhipment at Singapore only was allowed.

SPAIN.—In virtue of a Royal Decree of October 22nd, 1914, bonded warehouses have recently been established in Cadiz, reports the British Vice-Consul at that port. Goods placed in these warehouses remain free of import duties, transport and port works dues, until imported for consumption into Spain. If re-exported from bond they are not subject to these taxes. Merchandise may remain in the bonded warehouses for a period up to four years, except where it is liable to decay. Goods such as explosives and articles dangerous to the preservation of other merchandise or to the security of the buildings are not admitted.

A table of warehousing charges for deposited merchandise is included in an explanatory pamphlet forwarded by the Vice-Consul, a copy of which (in Spanish) may be inspected at the Commercial Intelligence Branch of the Board of Trade.

The prohibition of the exportation of articles wholly or partially manufactured with copper or brass has been withdrawn.

BERMUDA.—A new Customs Tariff came into force on January 1st, and will continue in force till December 31st. With few exceptions the rates of duty and the free list are identical with those previously in operation. It is provided, however, in the present Tariff that on all goods which are liable to specific or to *ad valorem* duties a surtax shall be levied of 10 per cent. on the amount of duty so payable.

EGYPT.—Revised Tariff valuations for use in assessing duties on certain metals imported into Egypt have been issued, with effect from April 1st to May 31st.

A Lamp Test.—A projecting bracket, beneath which was suspended an opal glass sign with the letters "G.E.C." upon it, was blown down during one of the recent gales, outside the branch premises of the General Electric Co., Ltd., at Swansea. An illustration that lies before us shows that the bracket terminated in a hook bearing a reflector and an Osram lamp. The opal sides of the sign was completely smashed, but the 1,500-watt Atmos-type Osram was found to be unbroken, and, when tested, gave forth its light as usual, the filament being intact.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

5,874. "Magnetic blow-out furnaces." G. H. NEEP AND SWITCHGEAR AND COWANS, LTD. April 25th.

5,875. "Intercommunication telephones." J. W. DUNGEY. April 25th.

5,884. "Electrically-operated temperature alarms." J. P. M. A. STRUYVEN. April 25th.

5,933. "Electrical switches." L. G. CAUNTER. April 25th.

5,934. "Electric locomotives." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). April 25th.

5,945. "Shields or guards for electric lanterns, electric torches, &c." N. J. AUSTIN & G. E. TAYLOR. April 25th.

6,003. "Lighting fittings." BRITISH THOMSON-HOUSTON Co. April 26th.

6,005. "Dry cells, and batteries thereof." C. F. BURGESS LABORATORIES. April 26th. (U.S.A., May 28th, 1915.)

6,031. "Electric devices for automatically turning lights on and off." E. STEIGER. April 27th. (Switzerland, April 28th, 1915.)

6,036. "Electric welding apparatus." E. WOLFMANN. April 27th. (U.S.A., May 1st, 1915.)

6,039. "Electrical generators for aircraft." G. E. MORTLEY. April 27th.

6,042. "Dry battery." F. P. BAUMANN. April 27th. (Switzerland, February 4th.)

6,044. "Assembling and uniting accumulator plates." A. ALLEGRANZA AND A. FORT. April 27th.

6,079. "Electric switches." P. L. DAVIES & J. H. WOOLLISCROFT. April 28th.

6,082. "Reflectors and shades for arc lamps, electric lights, &c." H. LEVY. April 28th.

6,089. "Electrolysis of brine in the manufacture of sodium hypochlorite, and apparatus therefor." R. S. CHAMBERS. April 28th.

6,091. "Acid and fume, gas, water, and vapour-proof electric lamp-holding device." A. WARNE. April 28th.

6,095. "Electrical indicating devices for taxicabs, &c." H. E. GILL & H. RICHARDSON. April 28th.

6,104. "Method of automatically taking up shrinkage of coils of electric transformers, &c." J. HALL & J. R. KIRK. April 28th.

6,106. "Distributors for magneto-electric machines." F. B. HALFORD. April 28th.

6,129. "Method of operating electrodes for projectors." E. A. SPERRY. April 28th. (U.S.A., June 28th, 1915.)

6,131. "Electrical resistances." A. H. CURTIS. April 28th.

6,150. "Method of automatically taking up shrinkage of coils of electric transformers." J. HALL & J. R. KIRK. April 29th.

6,151. "Electro-magnetic guns." D. S. CROWTHER & W. ROUTLEDGE. April 29th.

6,160. "Electric motor control systems." BRITISH THOMSON-HOUSTON Co (General Electric Co., U.S.A.). April 29th.

PUBLISHED SPECIFICATIONS.

1914.

22,045. ARRANGEMENTS FOR AUTOMATICALLY SWITCHING-OFF OR INDICATING DEFECTIVE SECTIONS OF ELECTRIC DISTRIBUTING NETS. M. Hochstadter. November 5th.

1915.

1,997. TELEGRAPH MACHINES. L. M. Potts. February 8th.

2,163. SYSTEM OF TELEGRAPHY. E. C. R. Marks (Delany Foreign Co.). February 10th.

5,168. MAGNETO IGNITION FOR INTERNAL-COMBUSTION ENGINES. J. W. T. Cadett & C. Percy. April 6th.

5,201. CIRCUIT BREAKERS, CURRENT LIMITERS, EXCESSIVE CURRENT INDICATORS, AND THE LIKE, FOR ELECTRIC CIRCUITS. E. T. R. Murray & G. F. Shotter. April 6th.

5,323. MINERS' ELECTRIC SAFETY LAMPS. J. G. Patterson. April 8th.

5,557. ELECTRIC RECTIFIERS AND METHODS OF OPERATING THE SAME. British Thomson-Houston Co. (General Electric Co., U.S.A.). April 13th.

5,596. ELECTRICAL RELAYS. J. Savin & Automatic Telephone Manufacturing Co. April 14th.

5,623. ELECTRICAL ALARM SYSTEMS. Siemens & Halske Akt. Ges. April 14th. (April 16th, 1914.)

5,731. PORTABLE PRIMARY BATTERIES OR CELLS. C. H. Elliot & Solectric Co. April 16th.

5,783. AERIAL CONDUCTORS FOR WIRELESS TELEGRAPHY. Marconi's Wireless Telegraph Co. & C. S. Franklin. April 17th.

6,991. SHORT-TIME ELECTRIC SWITCH. Landis & Gyr Akt. Ges. May 10th. (May 23rd, 1914.)

7,263. APPARATUS FOR PNEUMATIC CONVEYING OF SOLIDS. British Thomson-Houston Co. (General Electric Co., U.S.A.). May 14th.

7,826. ELECTRICAL TRANSFORMERS. S. Z. de Ferranti & Ferranti, Ltd. May 26th.

7,827. ELECTRICAL APPARATUS EMPLOYING OIL INSULATION. S. Z. de Ferranti, J. Roothaan & Ferranti, Ltd. May 26th.

7,840. VIBRATING MAKE-AND-BREAK DEVICES FOR USE IN ELECTRIC SIGNALLING. A. C. Brown. May 27th.

7,987. ROTARY ELECTRIC CONVERTERS. British Thomson-Houston Co. (General Electric Co., U.S.A.). May 29th.

8,546. ELECTRIC FUSE CARRIERS. A. C. Robinson. June 9th.

9,584. ELECTRIC WATER-HEATERS. G. P. Elmen, S. O. Salisbury & A. R. Talbot. June 30th. (December 26th, 1914.)

10,272. AMPLIFICATION OF WIRELESS SIGNALS. A. J. Roberts. July 14th.

11,033. MAGNETOS. M. A. Codd. July 29th.

11,208. DEVICES FOR GUIDING ROPES OR CABLES. Pickerings, Ltd., & J. Fothergill. August 3rd.

12,614. ELECTRIC ARRANGEMENTS FOR DISTANT CONTROL. Fried. Krupp Akt. Ges. September 2nd. (September 2nd, 1914.)

15,330. SWITCHING DEVICES FOR THE LOW-TENSION INDUCTION CIRCUIT OF AUTOMOBILE ENGINES. F. Pacon. October 30th.

18,084. TELEPHONE SYSTEMS. H. S. Turner. December 28th. (June 29th, 1914. Divided application on 6,480/15, April 30th.)

1916.

503. CABLE CLAMPS FOR ELECTRIC WIRING INSTALLATIONS. G. S. Boothroyd and Callender's Cable & Construction Co. May 21st, 1915. (Divided application on 7,647/15.) Patent No. 100,239.

4,402. TELEGRAPH MACHINES. L. M. Potts. February 8th, 1915. (Divided application on 1,997/15.) Patent No. 100,238.